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Genera of *Pezizales* of Argentina 1. An updating of selected genera

IRMA J. GAMUNDÍ

irmagamundi@gmail.com
Oscar Runge 910, 8400 San Carlos de Bariloche, Río Negro, Argentina

Abstract — Twenty-two genera of *Pezizales* from Argentina belonging to families *Discinaceae, Helvellaceae, Morchellaceae, Pezizaceae, Pyronemataceae, Sarcoscyphaceae,* and *Sarcosomataceae* are reviewed according to new nomenclatural and taxonomical parameters. Some changes in type species selection are noted and relationships among genera based on microscopical, ultramicoscopical, and molecular data are discussed. The related anamorphs, when known, are briefly described.

Resumen — Se revisan y actualizan veintidós géneros de *Pezizales* de Argentina pertenecientes a las familias *Discinaceae, Helvellaceae, Morchellaceae, Pezizaceae, Pyronemataceae, Sarcoscyphaceae* y *Sarcosomataceae* de acuerdo con nuevos conceptos taxonómicos y nomenclaturales. Se incluyen algunos cambios en la designación de las especies tipos con respecto a trabajos anteriores de la autora y comentarios de las relaciones filogenéticas entre los géneros, considerando datos microcópicos, ultramicroscópicos y moleculares. Se describen brevemente los anamorfos de cada género, cuando se los conoce.

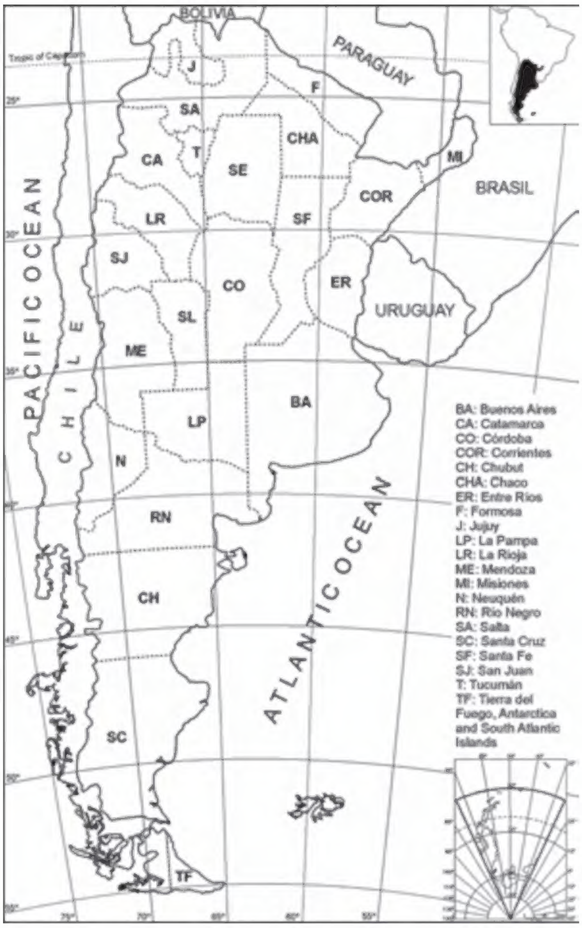
Key words — *Ascomycota*, cup-fungi, taxonomy, biodiversity

Introduction

About fifty years after the my first publication on discomycetes of Argentina, I thought that perhaps it would be worthwhile to produce an update of my work on the taxonomy of this group, mainly regarding current concepts and nomenclature of the genera.

During this time, generic concepts have been enriched and refined by the use of modern tools such as scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Moreover, molecular studies have helped clarify relationships between taxa, leading to hypothetical phylogenies.

Advances in the nomenclature of various discomycete taxa have also required changes to some generic and specific names used in my previous papers. However, as generic limits differ from author to author, I am giving my views and provide generic descriptions that cover my concepts.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CA: Catamarca
CO: Córdoba
COR: Corrientes
CH: Chubut
CHA: Chaco
ER: Entre Ríos
F: Formosa
J: Jujuy
LP: La Pampa
LR: La Rioja
ME: Mendoza
MI: Misiones
N: Neuquén
RN: Río Negro
SA: Salta
SC: Santa Cruz
SF: Santa Fe
SJ: San Juan
T: Tucumán
TF: Tierra del Fuego, Antarctica and South Atlantic Islands

Fig. 1. Map of Argentina

Argentina is an extensive country covering an area of 2,766,891 km², extending from 21°46'S to 55°03'S and 53°38'W to 73°35'W. The altitude decreases from W to E, ranging from the Andes, whose highest point is 6,962 m to sea level at the Atlantic coast, but with its lowest depression (−105m) in the Patagonian plateau. It encompasses different climates, from subtropical in the north, temperate in the center and south, and to polar if the Argentine Sector of Antarctica is included. The mycobiota is therefore very diverse. So far, many territories are still poorly explored regarding the discomycete biota and many genera and species are yet to be discovered.

At present, there are approximately 37 genera of *Pezizales* recognized from Argentina. I refer only to 22 in this contribution, choosing those that have been recently monographed or studied with ultrastructural or molecular tools. The remaining shall be treated in a next contribution.

The genera are presented in alphabetical order and include a description, type species, habitat, geographical distribution in Argentina, notes on related genera, and a bibliography. Abbreviated literature is presented at the end of the generic descriptions and full references can be found in the literature. Each genus is illustrated with a species recorded in Argentina, which is depicted in a plate (Plates 1–22). A map (Fig. 1) shows the provinces with the abbreviations listed in the accompanying legend. Taxonomic categories above genera follow Kirk et al. (2008) and the website "Index Fungorum" (http://www.indexfungorum.org/BSM./bsm.asp). Electronic libraries such as Cybertruffle (http//cybertruffle.org.

uk/cyberliber) and Biblioteca electrónica del Ministerio de Ciencia y Tecnología de la Argentina (http//www.biblioteca.mincyt.gov.ar) were very valuable information sources for this paper.

Ultrastructural references include Bellemère et al. (1990), Kimbrough (1994), Kimbrough & Curry (1986), Kimbrough & Gibson (1989, 1991), Kimbrough et al. (1990), Li & Kimbrough (1995, 1996a,b) and Meléndez-Howell et al. (2003). Molecular data were extracted from Hansen et al. (1999, 2001), Hansen & Pfister (2006), Harrington et al. (1999), Landvik et al. (1997, 1999), Læssøe & Hansen (2007), Liu & Zhuang (2006), O´Donnell et al. (1997), Perry et al. (2007), Perry & Pfister (2008), Tedersoo et al. (2006), and Weinstein et al. (2002).

Taxonomy

Acervus Kanouse emend. Pfister (*Pyronemataceae*)

Ascomata apothecial, medium-sized, superficial, sessile to subsessile, at first globose becoming shallow cupulate (cleistohymenial), scattered to gregarious, sometimes concrescent forming masses of several cm across arising from a mycelium agglomerated in a dense mat mixed with the substratum, firm fleshy consistency; disc bright yellow to orange, the pigment soluble in water and alcohol; margin entire or lobate, reflexed and undulate; external surface concolorous with the disc or paler, pruinose to furfuraceous. Ectal excipulum of textura globulosa to angularis composed of isodiametric cells, the most superficial smaller than the internal ones and containing orange granules, bearing flexuous, cylindrical, short, obtuse hair with few septa. Medullary excipulum well developed, of a lax textura intricata composed of hyaline hyphae with swollen articles. Subhymenium of dense textura globulosa, the cells containing pigment and smaller than those of the excipulum. Asci cylindrical, 8-spored, J–, dehiscence indistinct. Paraphyses robust, cylindrical, subclavate or irregularly enlarged, containing pigmented granules near the apex, pluriseptate. Ascospores uninucleate, 1-seriate, multiguttulate, hyaline, broad ellipsoidal with blunt ends to subglobose, smooth, thin-walled.

Type species: ***Acervus aurantiacus*** Kanouse Pap. Mich. Acad. Sci. 23:149. 1938 [= *A. epispartius* (Berk. & Broome) Pfister].

Habitat: on damp soil, sometimes among grass, rotten wood and debris.

Anamorph: unknown.

Notes: *Acervus* is an earlier synonym of *Phaedropezia* Le Gal. It shares with *Caloscypha* Boud. a bright orange-yellow disc and the same type of septal structure. TEM studies of the hyphae revealed that a membrane-like translucent band borders the pore plug where the Woronin bodies are crystalloid, a view that supports the inclusion of both genera in the same tribe of the *Pyronemataceae*. However, *Caloscypha* differs in the ascomata that turn green or bluish with age or when touched or broken. *Ascosparassis* Kobayasi is similar to *Acervus* in its small, guttulate ascospores, robust paraphysis, and orange ascoma of sparassoid habit. Formerly *Acervus* was placed in the *Sarcosomataceae* or *Sarcoscyphaceae* because asci were considered suboperculate. Other authors held the view that dehiscence is somewhat bilabiate, as in *Caccobius* Kimbr. and *Thelebolus* Tode (*Thelebolaceae*). Nevertheless operculate asci can be observed in the Argentine collection of *A. epispartius* (PLATE 1, FIG. 3). The fact that ascospores are uninucleate instead of multinucleate reinforces the view that *Acervus* belongs to the *Pyronemataceae*. This family is considered here in a wider sense than in Kimbrough´s (1989) proposal (in accordance with Kirk et al. 2008). Molecular phylogenetic studies show discrepancies in the concept of *Pyronemataceae*. Some authors consider it monophyletic, others think it is polyphyletic, but they agree that *Acervus* occupies an isolated place that forms a separate monophyletic group.

DISTRIBUTION IN ARGENTINA: only one collection of *A. epispartius* — cited as *A. aurantiacus* — has been found in Argentina from BA.

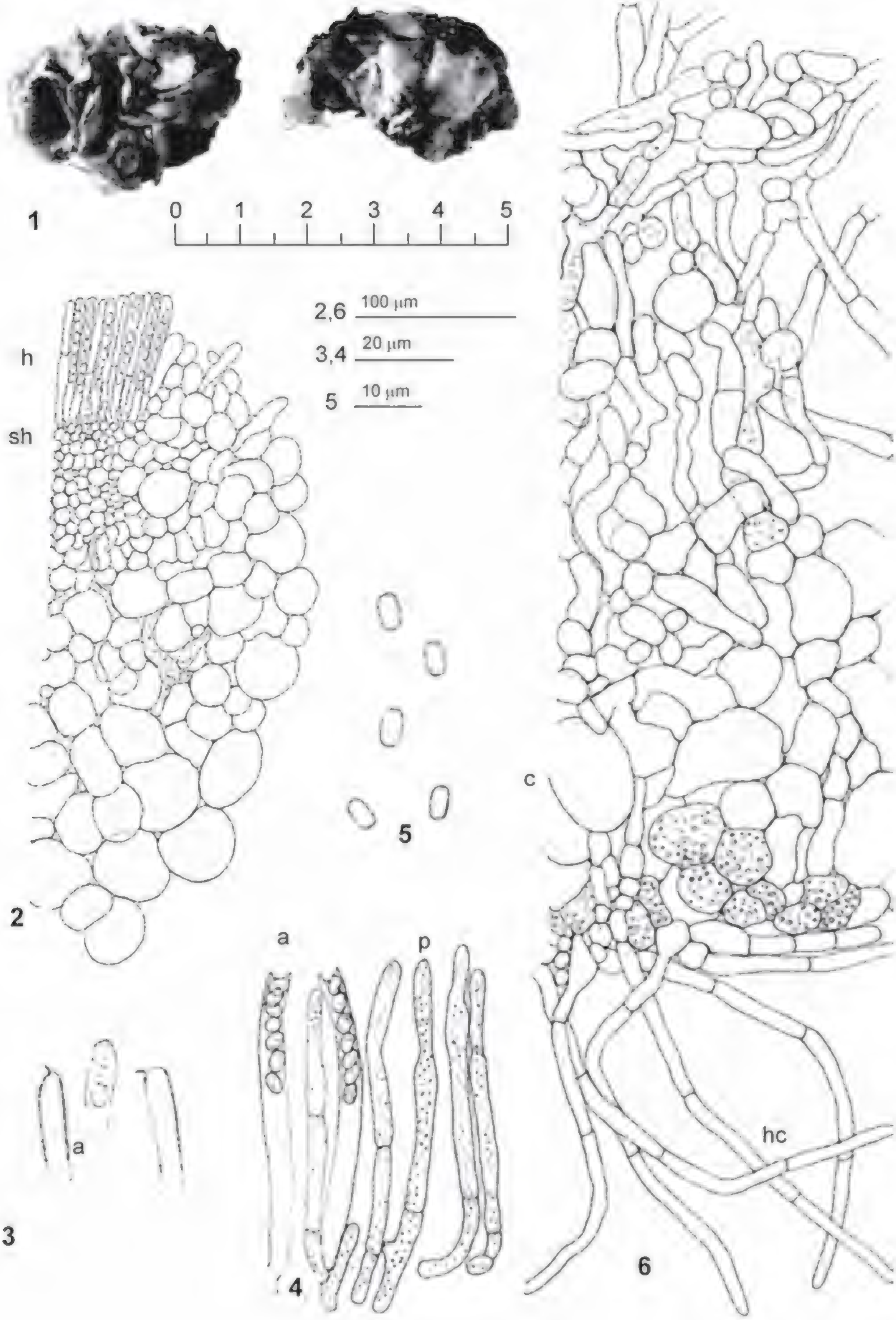
ILLUSTRATION: Pl. 1, 1–6. *Acervus epispartius.*

LITERATURE: Eckblad 1968; Gamundí 1970; Kimbrough 1989; Kimbrough & Curry 1986; Kirk et al. 2008; Korf 1963, 1988; Le Gal 1953; Liu & Zhuang 2006; Moravec 1983; Perry et al. 2007; Pfister 1975; Pfister & Bessette 1985; Pfister & Halling 1989; Zhuang & Wang 1998.

Aleuria (Pers.) Fuckel (*Pyronemataceae*)

ASCOMATA apothecial, small to large, up to 8 cm diam., superficial, sessile to subsessile, cupuliform to cochleate, scattered, gregarious or cespitose, bright coloured; disc smooth, yellow, orange to reddish orange, margin conspicuous; external surface paler than the disc, whitish in dried specimens, pruinose, furfuraceous to tomentose. ECTAL EXCIPULUM of textura angularis to textura globulosa of isodiametric or elongated cells, the external ones ending in superficial, hyphoid, short, obtuse, hyaline hairs. MEDULLARY EXCIPULUM of textura intricata composed of hyaline hyphae densely arranged. Septal pores of excipular cells (TEM) have a lamellate structure and globose Woronin bodies are associated with them. SUBHYMENIUM an orange-yellow zone of textura angularis, of small cells. ASCI cylindrical, 8-spored, J–. PARAPHYSES pluriseptate, subclavate or bent at the apex, containing granules of carotenoids (major pigments β- and γ-carotene, ester of aleuriaxanthine) that turn green with iodine. ASCOSPORES uninucleate, 1-seriate, containing 1-2 guttules, hyaline to pale yellowish, ellipsoidal, with a conspicuous cyanophilic ornamentation ridge- or net-like, sometimes forming apicula at both ends or with prominent pointed warts.

PLATE 1. 1–6. *Acervus epispartius* (LPS 35273). 1. Concrescent ascomata: frontal and lateral view. 2. Vertical section of the ascoma: h, hymenium, sh subhymenium. 3. Ascus apex. 4. Hymenium: a, mature asci, p, paraphyses. 5. Ascospores. 6. Vertical section at the base of the ascoma: c, excipulum, hc, basal hyphae.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6

Type species: ***Aleuria aurantia*** (Pers.) Fuckel, Jahrb. Nassauischen Vereins. Naturk. 23–24: 325. 1870.

Habitat: on sandy soil, rich forest soil or gravy soil along paths, frequently on disturbed sites, sometimes among grass or mosses.

Anamorph: unknown.

Notes: The cosmopolitan species *Aleuria aurantia* is commonly named orange peel peziza. The genus is close to *Melastiza* due to its mostly reticulate ascospores and paraphyses containing the same carotenoid pigments but differs in the external surface of the apothecium. This similarity led Moravec to unite them under the older name, *Aleuria,* with two subgenera *Aleuria* and *Melastiza.* At least one of Moravec´s arguments (i.e., 'the same habitat'; see Notes under *Melastiza*) for merging both genera is dubious. *Rhodopeziza* is also similar, sharing the coloured hymenium and the cyanophilic ascospore ornamentation, but differs in the weak J+ ascus wall reaction (see Notes under *Rhodopeziza*). TEM studies of septal structure in the ascal cell and the ascogenous hyphae show a granular opaque matrix, which borders the pore, appearing in older asci as a fan-shaped plug with a lamellate electron-translucent torus adjacent to the pore rim (referred to as the 'aleurioid' type). A phylogram derived from SSU rDNA sequences suggests that *Aleuria* is related to *Byssonectria* P. Karst. and forms a group containing the genera *Scutellinia, Cheilymenia,* and *Pyronema* Carus (Landvik et al. 1997). This clade is not supported by another study based on nLSU rDNA sequences (Perry et al. 2007). It appears that the presence of carotenoid pigment is of little phylogenetic significance.

Distribution in Argentina: *A. aurantia* is the only species recorded, distributed in BA, N, RN, SC, TF.

Illustration: Pl. 2, 1–6. *Aleuria aurantia.*

Literature: Arpin 1969; Gamundí 1960, 1975; Gamundí & Horak 2003; Gamundí et al. 2004; Häffner 1993; Kaushal 1976; Kimbrough 1989, 1994; Kimbrough & Curry 1986; Landvik et al. 1997; Liu & Zhuang 2006; Moravec 1972, 1994a; Perry et al. 2007; Rifai 1968; Spooner & Yao 1995.

Aleurina Massee (*Pyronemataceae*)

Ascomata apothecial, medium-sized, superficial, sessile to subsessile, scattered to gregarious, cup shaped to discoid at maturity, the base with abundant subhyaline hyphae often enmeshing soil particles; disc olivaceous, brown to

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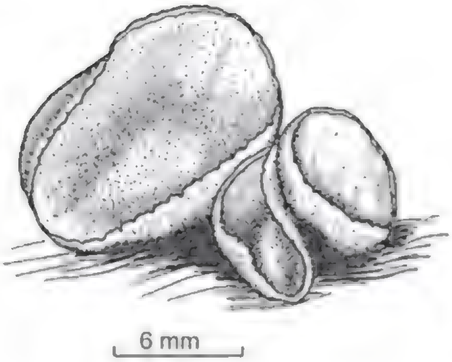
Plate 2. 1–6. *Aleuria aurantia* (BAFC 21059). Ascomata. 2. Medullary excipulum. 3. Receptacle: surface hairs. 4. Ascospores. 5. Vertical section of the ascoma: sh, subhymenium, m, medullary excipulum, c, ectal excipulum. 6. Ascus and paraphyses.



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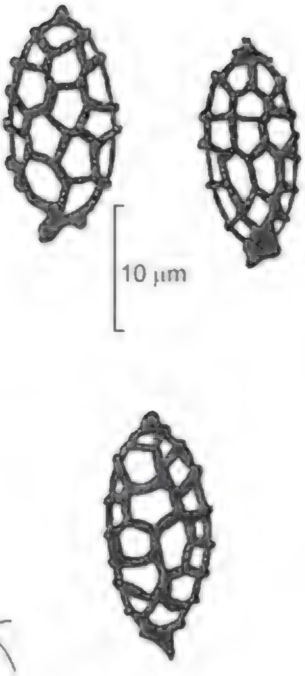

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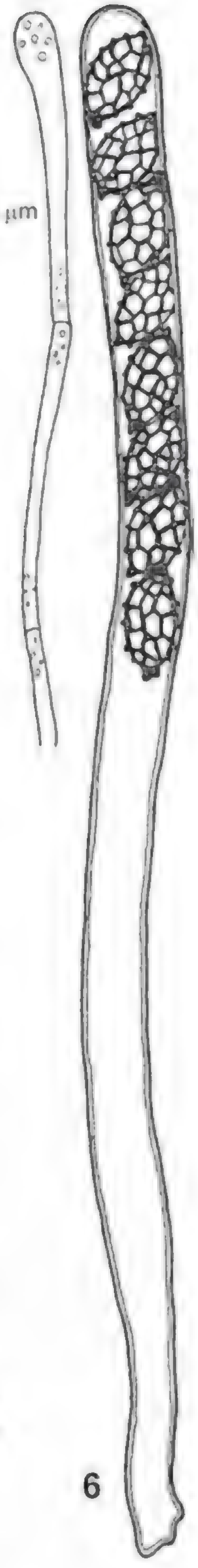

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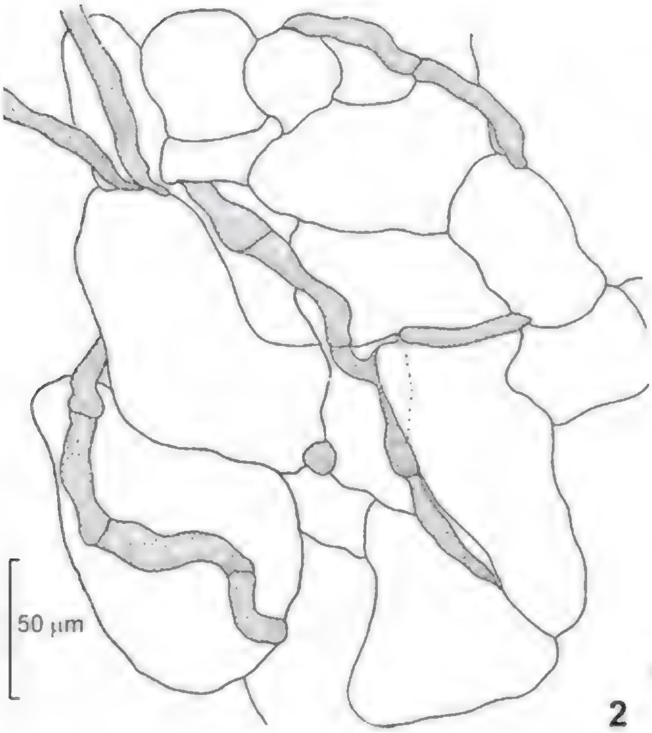

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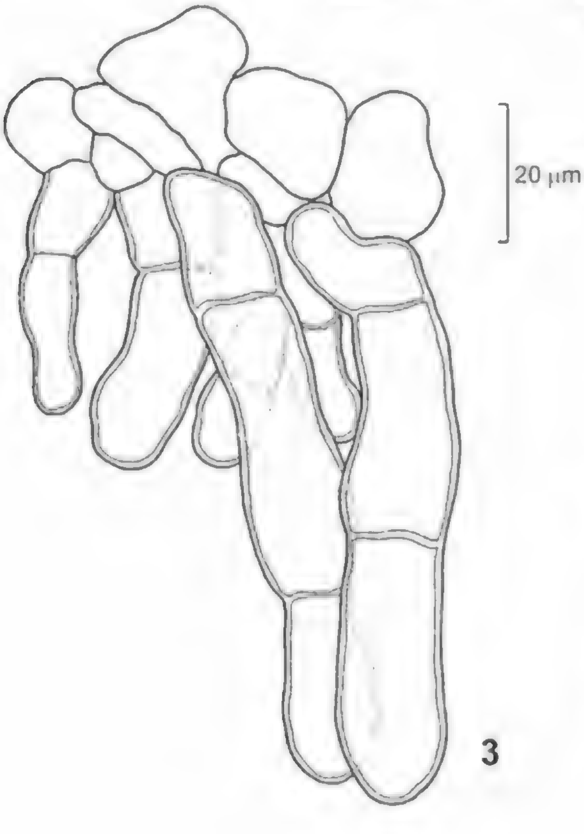

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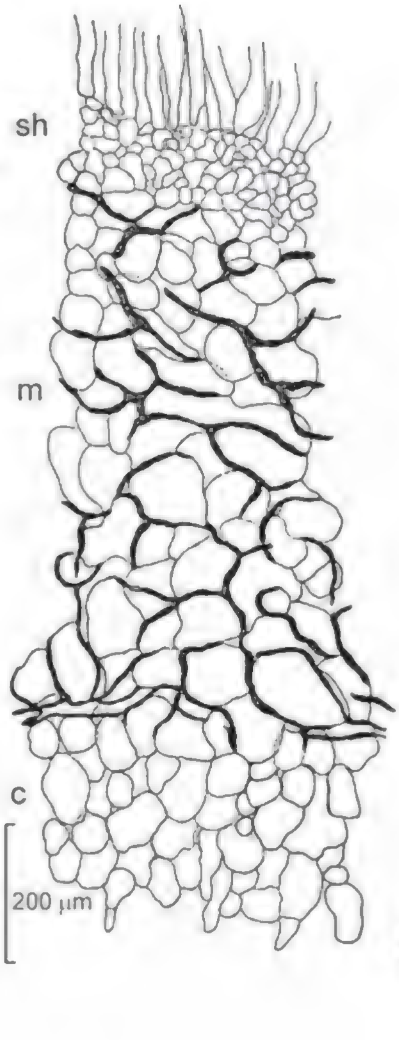

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purplish brown; external surface brown to reddish brown, smooth but pustulate near the margin. ECTAL EXCIPULUM a textura angularis of isodiametric to elongated polygonal light brown cells disposed at right angle to the surface, the most superficial smaller, subglobose with thick dark brown walls, aggregated to form the marginal pustules, sometimes with an extra inner layer of small cells with dark brown walls. MEDULLARY EXCIPULUM of textura intricata, composed of pale brown hyphae running horizontally. SUBHYMENIUM of compact textura intricata. ASCI cylindrical, 4- or 8-spored, J–. PARAPHYSES subcylindrical, subclavate or subcapitate, containing a dark, opaque, brown pigment at the apex, septate. ASCOSPORES uninucleate, 1-seriate, mostly 2-guttulate, hyaline to pale yellow, ellipsoidal, ornamented with cyanophlic conical or rounded warts or spines.

TYPE SPECIES: ***Aleurina tasmanica*** Massee, Bull. Misc. Inf., Kew 1898.

HABITAT: on soil sometimes among bryophytes, wood, or duff.

ANAMORPH: unknown.

NOTES: *Aleurina* is an earlier synonym of *Jafneadelphus* Rifai (1968). It is close to *Jafnea* Korf emend. Rifai in the structure of the ectal excipulum but this genus has superficial brown hairs, a cushion-like pseudostipe, and fusoidal to fusiform-ellipsoidal ascospores. It is also distinct from *Eoaleurina* Korf & W.Y. Zhuang characterized by the ectal excipulum of textura globulosa to angularis with cells of thin, hyaline walls, the most superficial with pigmented cytoplasm. *Smardaea* Svrček differs in the presence of a purplish, water-soluble pigment in the medullary excipulum. A phylogenetic analysis based on LSU rDNA sequences places *Aleurina* in a group that includes *Smardaea.*

DISTRIBUTION IN ARGENTINA: Two species are recorded: *A. argentina* (Rifai) Korf & W.Y. Zhuang, and *A. echinata* (Gamundí) Korf & W.Y. Zhang from N, RN, TF.

ILLUSTRATION: Pl. 3, 1–8. *Aleurina echinata.*

LITERATURE: Eckblad 1968; Dissing 2000; Gamundí 1972a, 1975; Gamundí et al. 2004; Hansen et al. 2001; Korf 1960; 1973a; Rifai 1968; Zhuang & Korf 1986.

Anthracobia Boud. (*Pyronemataceae*)

ASCOMATA apothecial, small- to medium-sized, sessile, discoid, gregarious of fleshy consistency; disc, smooth, plane to concave, yellowish, ochraceous, orange, reddish to grayish brown; margin conspicuous, undulated, sometimes striated due to tufts of hairs; external surface punctuate, covered irregularly

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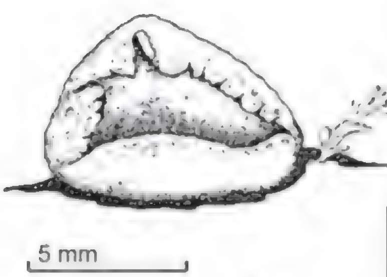
PLATE 3. 1–8. *Aleurina echinata* (BAFC 20856). 1. Ascoma. 2. Detail of the medullary excipulum (m) and inner layer of the ectal excipulum (ci) .3. Vertical section of the ascoma: h, hymenium, sh, subhymenium, c, ectal excipulum, m, ci, as in FIG. 2. 4. Sketch of a vertical section of the ascoma: h, m, c, as is FIG. 3. 5. Ascospores. 6. Detail of ectal excipulum. 7. Paraphyses. 8. Ascus.



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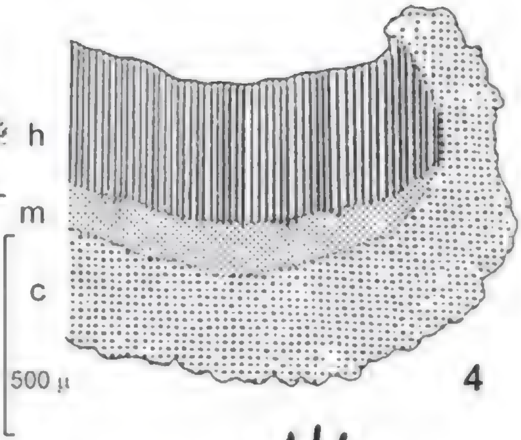

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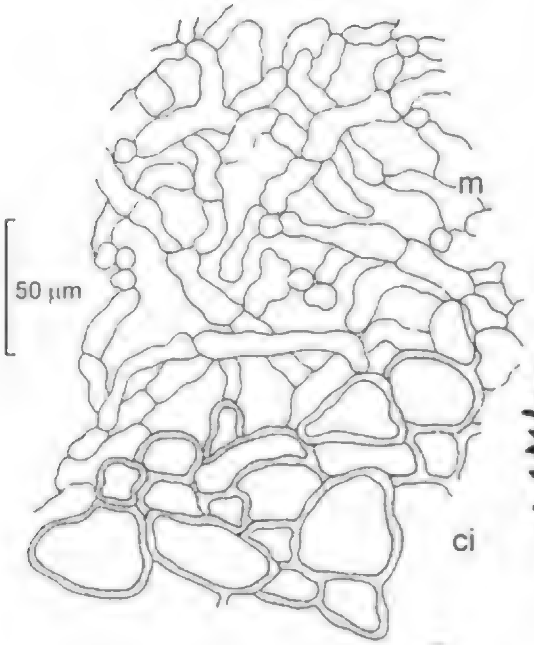

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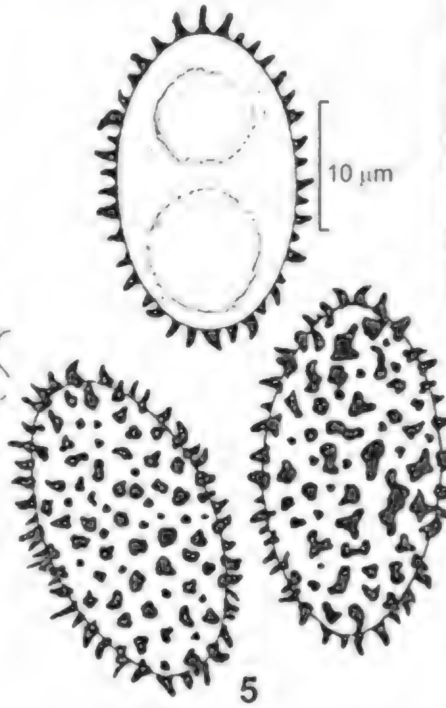

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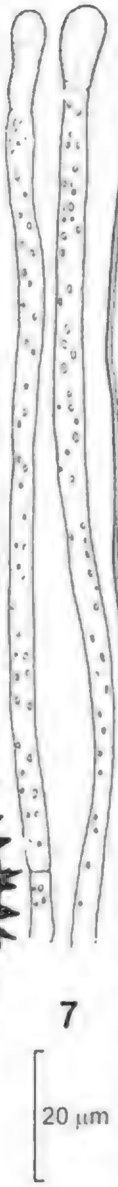

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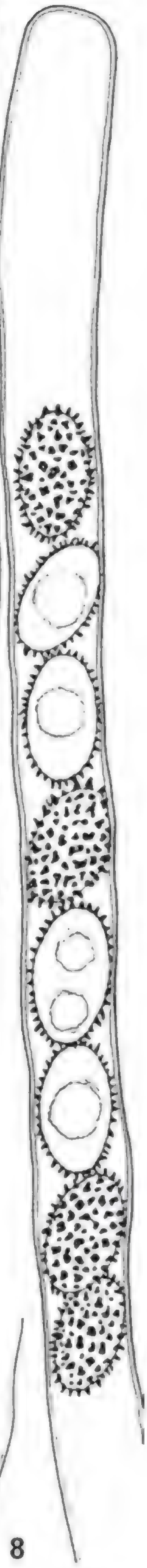

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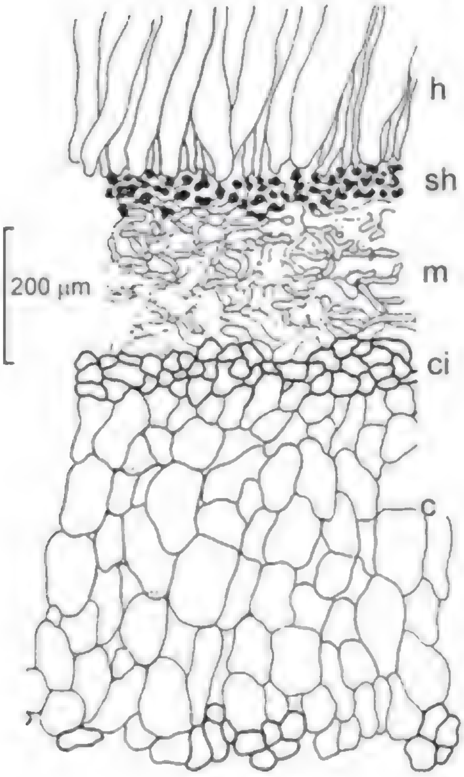
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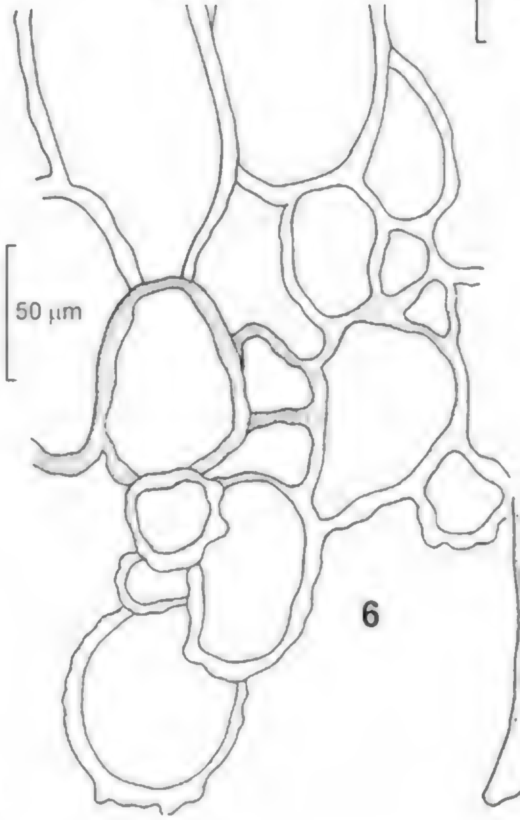

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with bunches of short, superficial, brown, blunt, flexuous or straight hairs with few septa. Ectal excipulum of textura angularis composed of isodiametric cells of hyaline to brownish walls, arranged in rows perpendicular to the external surface, the most superficial extending sometimes to form hairs. Medullary excipulum of textura intricata, hyaline. Asci cylindrical, 8-spored, J–. Paraphyses clavate at the apex and containing granules of pigment. Ascospores uninucleate, 1-seriate, 2- to multiguttulate, sometimes with de Bary bubble, hyaline, smooth, ellipsoidal.

Type species: ***Anthracobia melaloma*** (Alb. & Schwein.) Arnould, Bull. Soc. Mycol. France 9:112. 1893.

Habitat: anthracobiontic, typically on burnt soil or charred wood.

Anamorph: *Scytalidium*-like, as registered in Kirk et al. (2008). *Scytalidium* Pesante is a dematiaceous hyphomycete that forms chains of brown and hyaline, 0–1 septate arthroconidia.

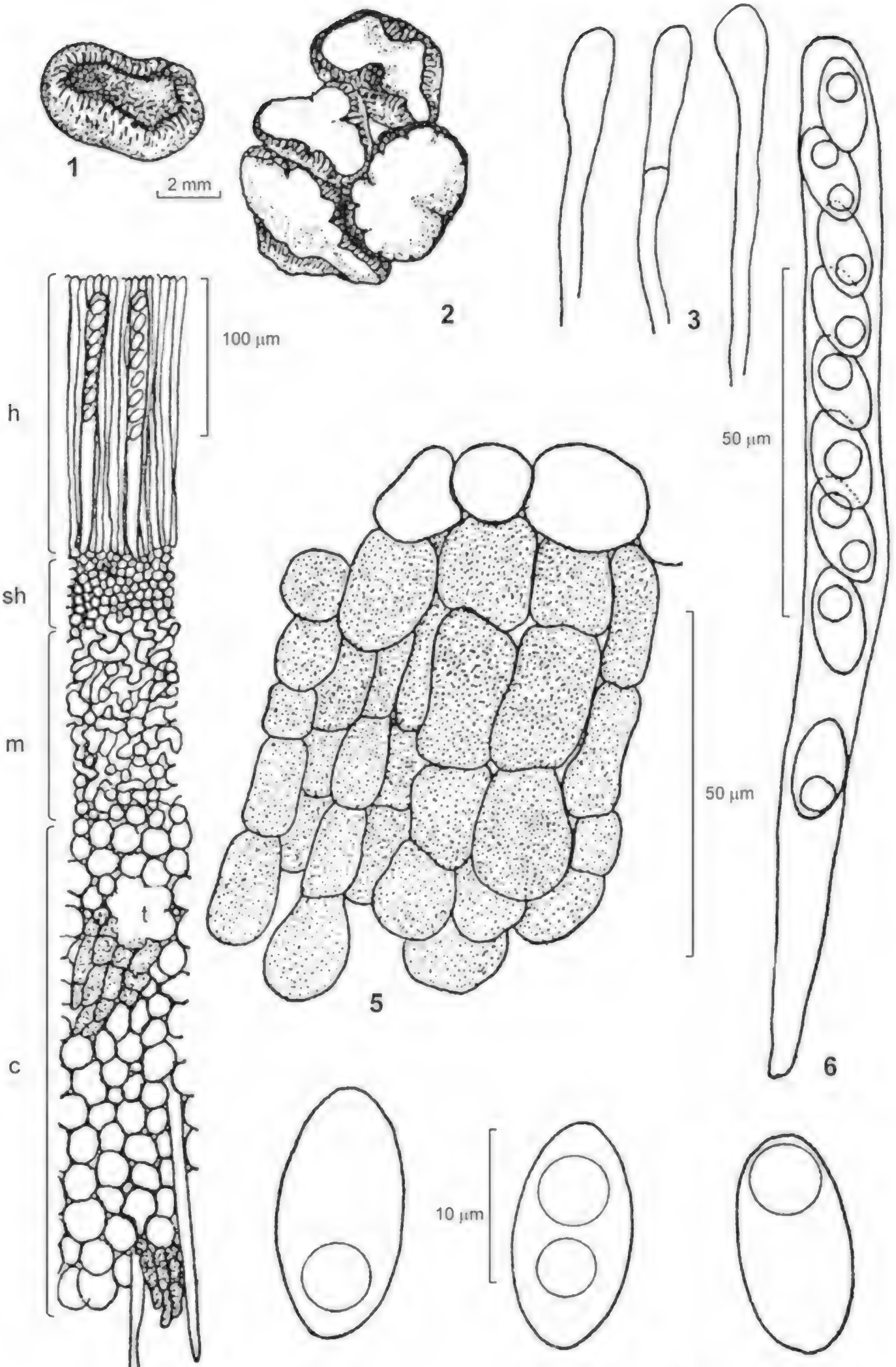
Notes: *Anthracobia* is similar to *Melastiza* that also has blunt, brown, short hairs but in this genus the ascospores have ornamented epispore (see description of *Melastiza*). Septal structure in *Anthracobia* ascogenous hyphae (TEM) shows pores filled with an electron-opaque granular matrix, and paraphyses with crystalloid, hexagonal, or rectangular Woronin bodies around the septal pore. It is also related to *Trichophaea*, which has long, pointed hairs. Recent phylogenetic studies based on partial sequences of nLSU rDNA support this relationship but boundaries between both genera remain unclear. It is also suggested that both genera are non-monophyletic. Another molecular study based in SSU rDNA sequences support the close relationship between *Anthracobia* and *Sphaerosporella* (Svrček) Svrček & Kubička, distinct by its globose ascospores. In a recent ecological paper the authors hypothesize that *Anthracobia*, as other postfire fungi, is one of the pivotal species in early restoration of forest systems after disturbance, binding soil particles in the absence of plant roots and potentially helping to reestablish the vegetation.

Distribution in Argentina: Two species are recorded: *A. melaloma* and *A. maurilabra* (Cooke) Boud. from BA, ER, S.

Illustration: Pl. 4, 1–7. *Anthracobia melaloma.*

Literature: Claridge et al. 2009; Dennis 1978, 1995; Dissing 2000; Gamundí 1960, 1975; Hansen & Pfister 2006; Kimbrough & Curry 1986; Kirk et al. 2008; Liu & Zhuang 2006; Perry et al. 2007; Rifai 1968; Sigler & Carmichael 1976; Sigler & Wang 1990; Svrček & Kubička 1961; Yao & Spooner 1995c, 1996b.

Plate 4. 1–7. *Anthracobia melaloma* (LPS 18527). 1. Ascoma. 2. Gregarious ascomata. 3. Paraphyses. 4. Vertical section of the ascoma: h, hymenium, sh, subhymenium, m, medullary excipulum, c, ectal excipulum, t, tuft of hairs. 5. Detail of the ectal excipulum. 6. Ascus. 7. Ascospores.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Cheilymenia Boud. (*Pyronemataceae*)

Ascomata apothecial small- to medium-sized, superficial, sessile, barrel-shaped, lenticular or scutellate, scattered to gregarious, usually bright coloured; disc smooth, plane to convex, yellow, orange to reddish; margin conspicuous, hairy; external surface the same colour of the disc or paler; hairs hyaline, yellowish to brown, 100–1000 µm long, pluriseptate, simple, forked or bulbous at the base, arising deeply from the excipulum, in some species also with superficial hairs, stellate or hyphoid, mainly at the base of the ascoma. Ectal excipulum of textura angularis to textura globulosa of isodiametric cells. Medullary excipulum poorly differentiated, a textura intricata to epidermoidea of hyaline hyphae. Asci cylindrical to subcylindrical, operculate, usually 8-spored, J–. Paraphyses pluriseptate, straight, subclavate at the apex, usually containing carotenoid granules, γ-carotene as a major pigment. Ascospores uninucleate, 1-seriate, usually eguttulate, hyaline to pale yellowish, ellipsoidal, smooth or verruculose, longitudinally striate, cristulate with crests that can anastomose, the perispore easily separable and delicate, cyanophilic.

Type species: ***Cheilymenia stercorea*** (Pers.) Boud., Icones Mycol. Liste Préliminaire [3] 1904.

Habitat: on soil, plant debris, dung, liverworts.
Anamorph: unknown.

Notes: *Cheilymenia* is closely related to *Scutellinia.* Both share morphogical characters such as hairs arising deeply from the excipulum and the same major pigment. TEM studies in apothecial tissues of *Cheilymenia* revealed that pores in ascogenous hyphae are occluded by Woronin bodies covered by a deeply staining amorphous electron opaque substance, a scutellinioid-type feature that is shared with *Scutellinia.* A SSU rDNA sequence-based study shows that *C. coprinaria* (Cooke) Boud. [= *C. fimicola* (De Not. & Bagl.) Dennis] and some species of *Scutellinia* are sister groups and that *C. stercorea* is closer to *Byssonectria.* Other studies support the view that this genus is not monophyletic. Several features separate *Cheilymenia* from *Scutellinia:* a) *Cheilymenia* has also superficial hairs and otherwise the rooting hairs can be pigmented or hyaline; b) ascospores eguttulate, if verruculose or striate, show a delicate outer wall (perispore) that separates when treated with lactic acid; and c) globose ascospores have never been recorded. Some species of *Cheilymenia* are related to *Coprobia* but the latter has hairless apothecia, the excipulum totally of textura globulosa, and the robust and capitate paraphyses. However, based on SEM studies in the

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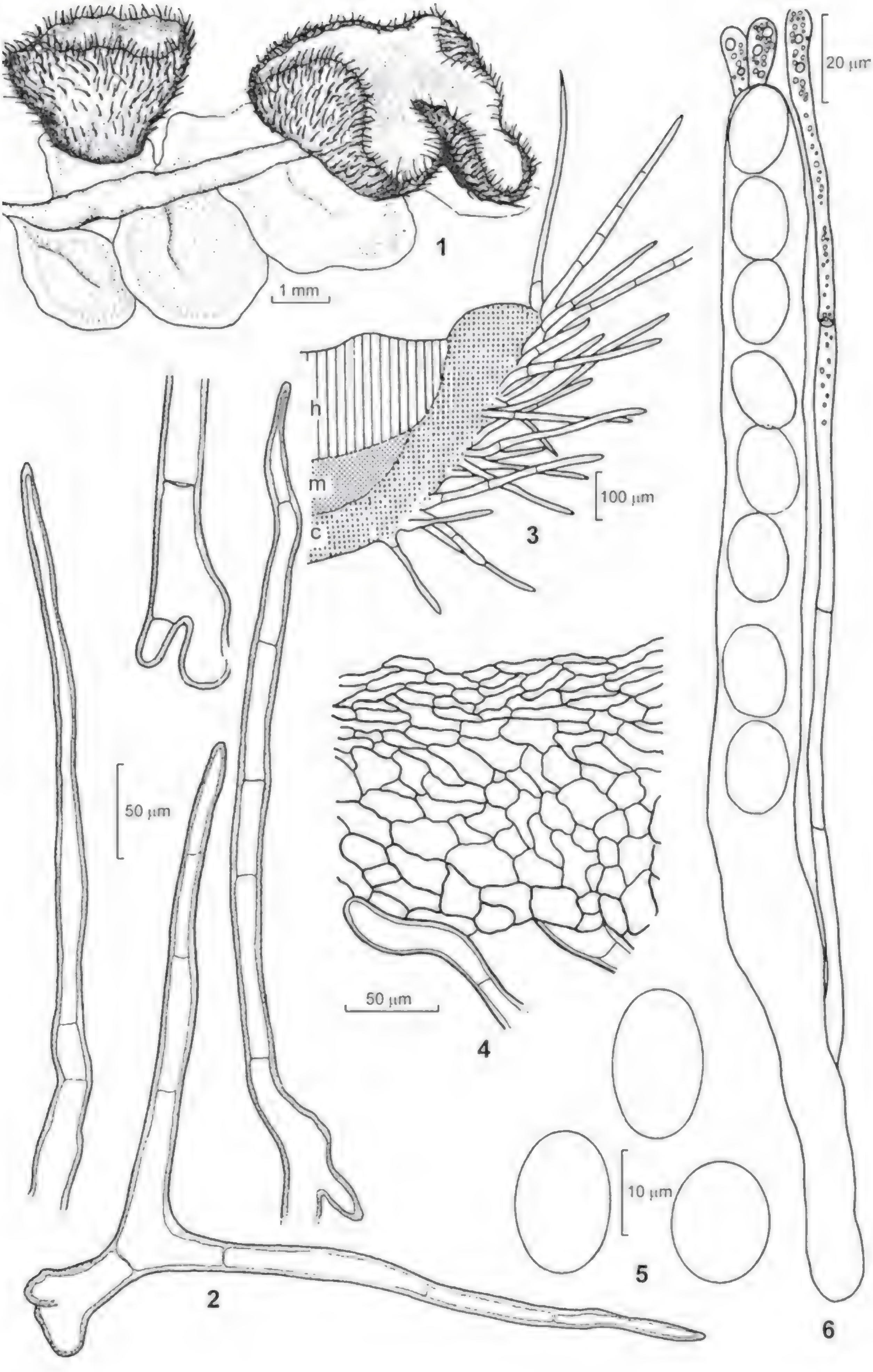
Plate 5. 1–6. *Cheilymenia villosa* (LPS 36718). 1. Ascomata on liverworts. 2. Marginal hairs. 3. Sketch of a vertical section of the ascoma: h, hymenium, m, medullary excipulum, c, ectal excipulum. 4. Ectal excipulum with basal hairs. 5. Ascospores. 6. Ascus and paraphyses.


1
1 mm
2
50 µm
3
h
m
c
100 µm
4
50 µm
5
10 µm
6
20 µm

ascospore wall, Moravec merged both genera under *Cheilymenia*, proposing an infrageneric classification and recognizing nine sections, including *Coprobiae*. I think that in the sense of this author the concept of the genus is a very wide assemblage of diverse species.

Distribution in Argentina: two species are recorded from a Central province (BA): *C. hyalochaeta* (Speg.) Gamundí and *C. fraudans* (P. Karst.) Boud. and seven species from Patagonia (N, RN, SC, T, TF): *C. megaspora* (Gamundí) J. Moravec, *C. fimicola C. humarioides* (Rehm) Gamundí, *C. raripila* (W. Phillips) Dennis, *C. stercorea, C. theleboloides* (Alb. & Schwein.) Boud., *C. villosa* Gamundí.

Illustration: Pl. 5, 1–6. *Cheilymenia villosa.*

Literature: Arpin 1969; Denison 1964; Gamundí 1960, 1966, 1972b, 1975; Gamundí et al. 2004; Kimbrough 1994; Kimbrough & Curry 1986; Liu & Zhuang 2006; Moravec 1968, 1984, 1989, 1990, 1994b, 1998, 2003, 2005, 2006; Perry et al. 2007; Wu & Kimbrough 1992.

Cookeina Kuntze (*Sarcoscyphaceae*)

Ascomata apothecial, medium-sized to large, cup shaped, superficial, sessile, subsessile to stipitate, scattered to gregarious, usually bright coloured, but occasionally pale; disc concave, smooth, in several shades of orange, pink, reddish, purplish or brownish; margin conspicuous, elevated; external surface, pruinose, furfuraceous or hirsute, paler than the disc; furfuration consisting of conical mounds; hairs, when present, fasciculate, covering margin and receptacle, sometimes down the stipe, arising from the medullary or ectal excipulum. Ectal excipulum thin, of textura angularis to globulosa of isodiametric cells arranged in rows perpendicular to the surface where they aggregate in conical or dome-like projections that gives the scurfy appearance to the receptacle. Medullary excipulum well developed, a textura porrecta of hyaline hyphae parallel to the surface of the receptacle, sometimes forming a gelatinous layer, which gives a subgelatinous consistency to the ascoma. Asci cylindrical to subcylindrical, suboperculate (asymmetrical operculum), thick walled (three layers visible with TEM), contracted below forming an apendiculate base, 8-spored, J–, maturing simultaneously. Paraphyses pluriseptate, filiform, straight, profusely branched near the apex, sometimes anastomosing and forming a delicate net, containing carotenoids (major pigment phillipsiaxanthine). Ascospores multinucleate, 1-seriate, containing 1–2 large guttules, hyaline to pale yellowish, ellipsoidal to fusoid, sometimes apiculate at both ends and inaequilateral, smooth or striate, in this case with longitudinal ridges that occasionally anastomose between them or connected

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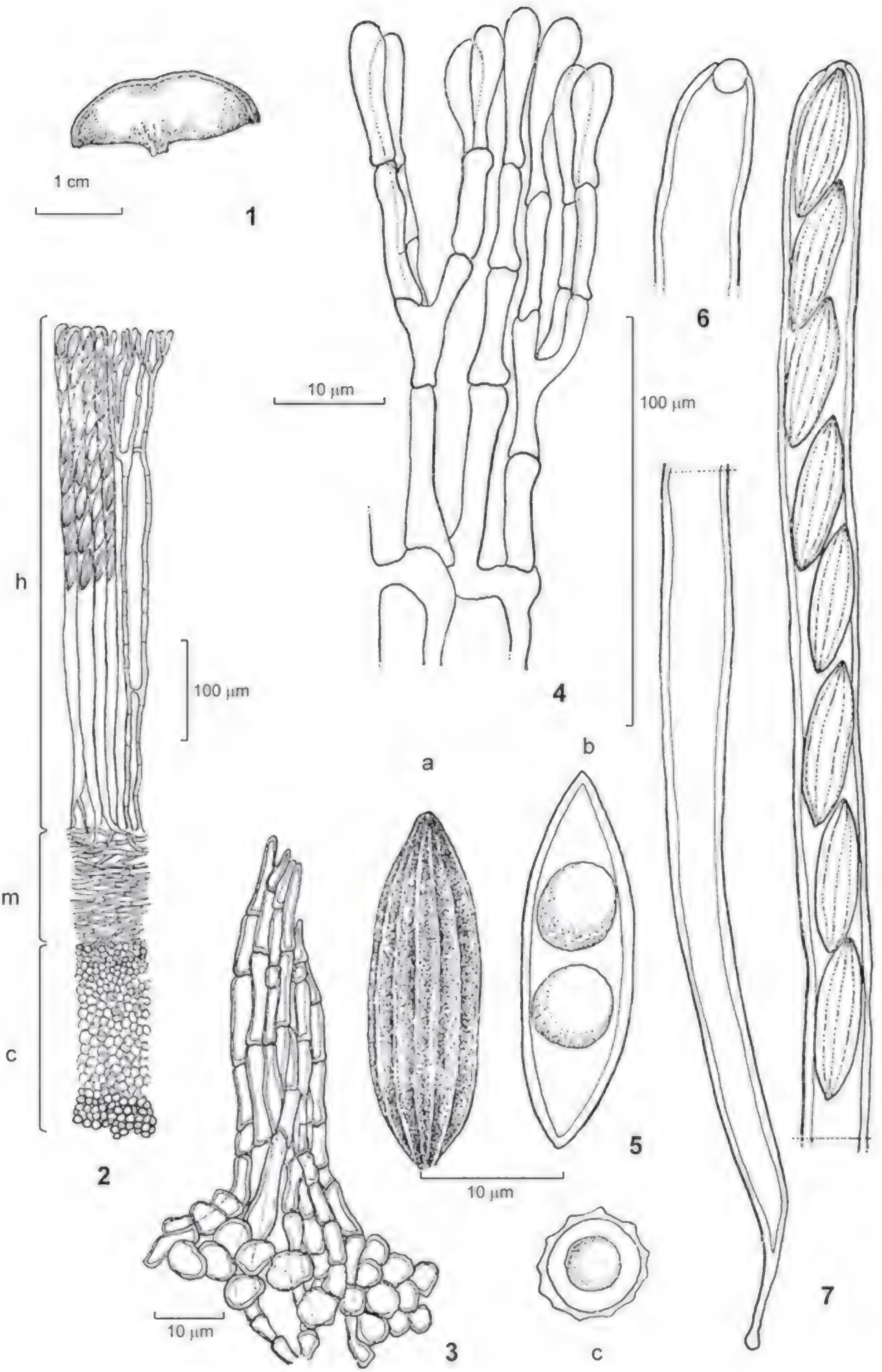
Plate 6. 1–7. *Cookeina venezuelae* (LIL, Singer T-2291). 1. Ascoma. 2. Vertical section of the ascoma: h, hymenium, m, medullary excipulum, c, ectal excipulum. 3. Fascicle of excipular hairs. 4. Paraphyses. 5. Ascospores: a, surface view, b, optical vertical section, c, optical cross section. 6. Ascus apex. 7. Ascus.


1 cm
1
h
m
c
100 µm
2
10 µm
4
100 µm
6
a
b
10 µm
5
c
3
10 µm
7

by fine transverse markings not stained with lactic blue (cyanophobic), wall two layered.

TYPE SPECIES: ***Cookeina tricholoma*** (Mont.) Kuntze, Revisio Genera Plantarum 2: 849. 1892.

HABITAT: on fallen angiosperm branches, logs, dead twigs or wood and debris.

ANAMORPH: ascospores germinate giving rise to globose to subglobose, hyaline, conidium-like structures.

NOTES: *Cookeina* shows affinities with *Microstoma* Bernstein, *Boedijnopeziza* S. Ito & S. Imai, and *Phillipsia. Microstoma* differs in having a multilayered excipulum, simple, flexuous hairs, and universally smooth ascospores. Molecular analysis shows that *Cookeina* and *Microstoma* Bernstein are sister groups. Morphologically *Boedijnopeziza* differs from *Cookeina* by its turbinate or urceolate ascoma and the origin of hairs. Molecular studies demonstrate a close relationship between both genera suggesting synonymy. Therefore the type species, *Boedijnopeziza insititia* (Berk. & M.A. Curtis) S. Ito & S. Imai has been transferred to *Cookeina. Phillipsia,* which differs in the microstructure of the ectal excipulum, a textura intricata to porrecta that gives a coriaceous consistency to the ascoma, the simple superficial hairs, and the universally inequilateral ascospores, is widely recognized as different from *Cookeina.*

This genus is pantropical and distributed in the tropics and subtropics. The drawings of *C. venezuelae* (Berk. & M.A. Curtis) Le Gal that illustrate this genus are based on collections from Tucumán, Argentina (LIL T-2291) and show only longitudinal ridges but not the fine transversal interconnecting ridges noted by Iturriaga and Pfister on material from Colombia (FH 1161).

DISTRIBUTION IN ARGENTINA: *C. colensoi* (Berk.) Seaver, *C. tricholoma,* and *C. venezuelae* are recorded from the subtropical area: BA, J, M, T.

ILLUSTRATION: Pl. 6, 1–7. *Cookeina venezuelae.*

LITERATURE: Arpin 1969; Boedijn 1933; Cabello 1988; Denison 1967; Eckblad 1968; Gamundí 1957a, 1959, 1983; Harrington et al. 1999; Iturriaga & Pfister 2006; Le Gal 1953; Meléndez-Howell et al. 2003; Romero & Gamundí 1986; Paden 1975, 1984; Weinstein et al. 2002; Zhuang & Wang 1998.

Coprobia Boud. (*Pyronemataceae*)

ASCOMATA apothecial, small, superficial, sessile, scutellate to pulvinate, gregarious, ochraceus-orange, disc plane to convex, often granulose due to the protruding ripe asci; external surface hairless, paler than the disc. EXCIPULUM 1-layered, of textura globulosa comprising large, isodiametric cells up to 100 µm,

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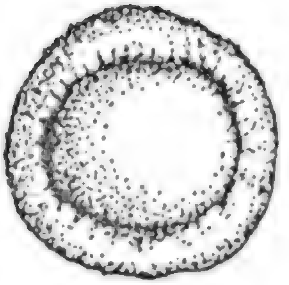
PLATE 7. 1–7. *Coprobia granulata* (LPS 27324). 1–2. Ascomata. 3. Vertical section of the ascoma: h, hymenium, sh, subhymenium, e, excipulum. 4. Paraphyses. 5. Ascus. 6. Mature ascospore. 7. Young ascospore.



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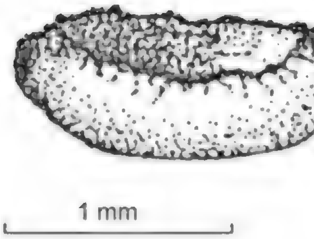

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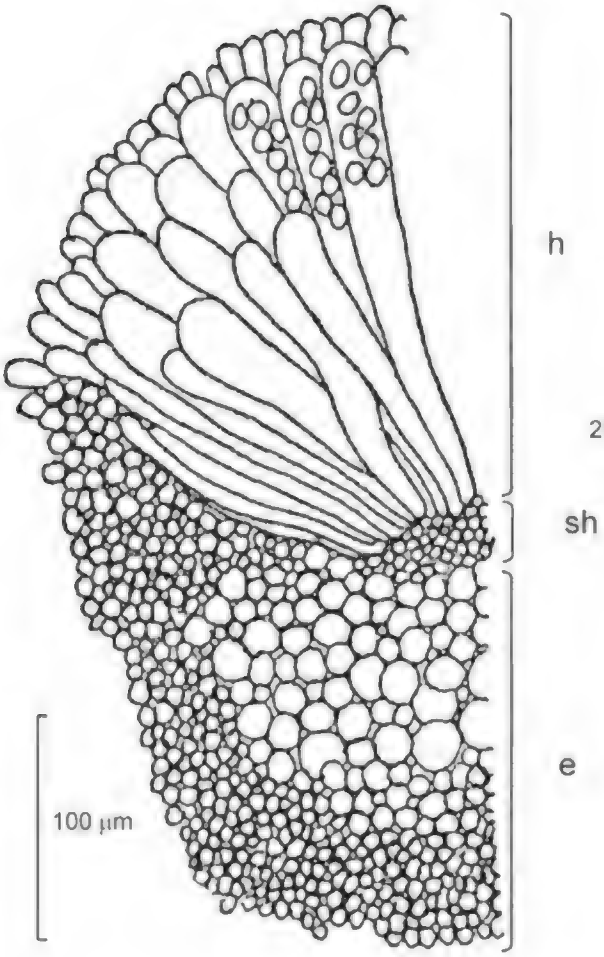

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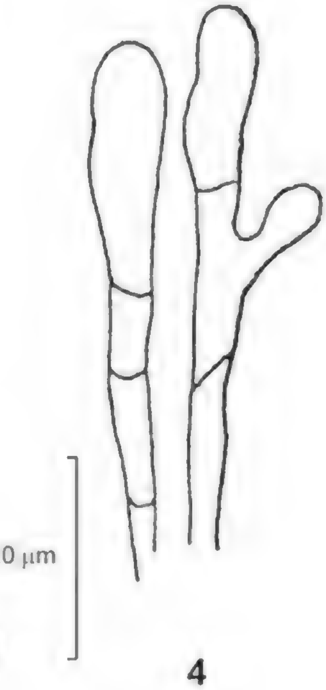

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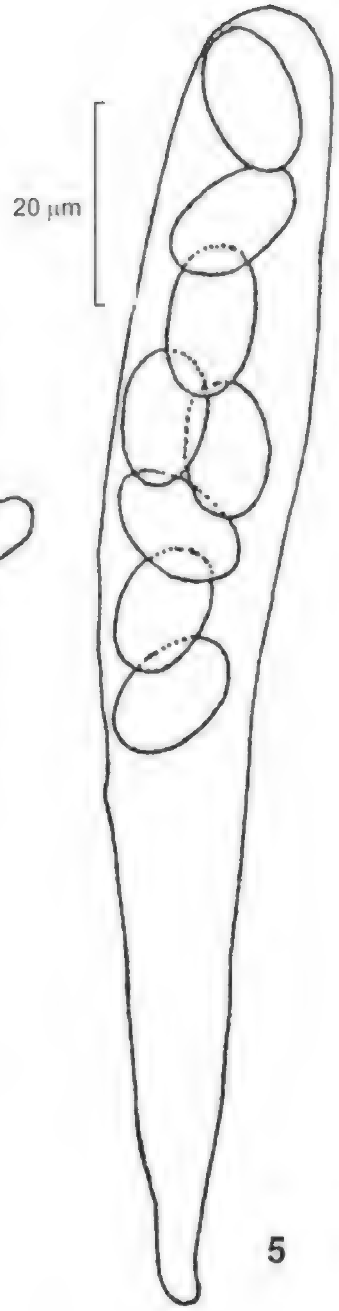

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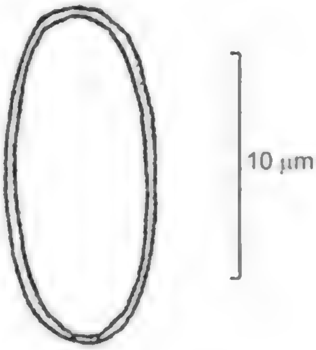

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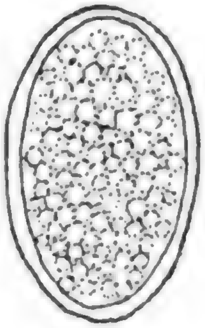

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in the exterior of the receptacle smaller in the inner part. Asci subcylindrical, operculate, 8-spored, J–. Paraphyses pauci-septate, robust, straight, capitate at the apex, containing granules of carotenoids (major pigments β- and γ-carotene). Ascospores uninucleate, 1-seriate, hyaline, without oil guttules, ellipsoidal, smooth or finely striate, with the outer wall easily loosened when heated in lactic acid.

Type species: ***Coprobia granulata*** (Bull.) Boud., Hist. class. Discom. d´Europe: 69. 1907.

Habitat: on dung of several herbivorous mammals and manure.
Anamorph: unknown.

Notes: *Coprobia* is related to *Cheilymenia.* Main distinctions are: a) the latter is conspicuously hairy, the hairs being rooting and sometimes having superficial hairs; b) the excipulum usually differenciated in two layers; and c) paraphyses are more slender than in *Coprobia.* Moravec at first recognized *Coprobia*, including also a new species, but in his later revision of *Cheilymenia*, he considered *Coprobia* a section of *Cheilymenia* (see Notes under *Cheilymenia*). His conception of this genus is very wide and is based mainly on the morphology of the ascospores. Other authors maintain *Coprobia* as a separate genus, emphasizing the structure of the excipulum, entirely of textura globulosa, and the receptacle devoid of hairs. These features are nowadays accepted in discomycete taxonomy as valuable characters for distinguishing genera. I accept this view. Furhermore, in *Coprobia granulata* the hymenial surface appears rough from protruding asci and capitate paraphysis, a character absent in *Cheilymenia.*

Distribution in Argentina: only *C. granulata* is recorded from BA. Rehm (1899) described *Humaria granulata* f. *guanaconis* Rehm and *Humaria guanaci* Rehm from Tierra del Fuego, both on "guanaco" (*Lama guanicoe*) dung. These most probably are *Coprobia granulata*, but the type specimens are both missing.

Illustration: Pl. 7, 1–7. *Coprobia granulata.*

Literature: Arpin 1968; Dennis 1978, 1986, 1995; Gamundí 1960, 1975; Gamundí et al. 2004; Moravec 1984; Rifai 1968; Rehm 1899.

Geopora Harkn. emend. Burds. (*Pyronemataceae*)

Ascomata cupulate, globose to subglobose, solitary or gregarious; hypogeous forms closed but sometimes opening superficially at maturity, discharging ascospores actively (puffing); hymenial surface concave or convoluted; outer surface covered by a dense mat of dark hairs. Hymenium smooth or convoluted (ptychothecia). Ectal excipulum of textura angularis, cells up to 60 µm diam.,

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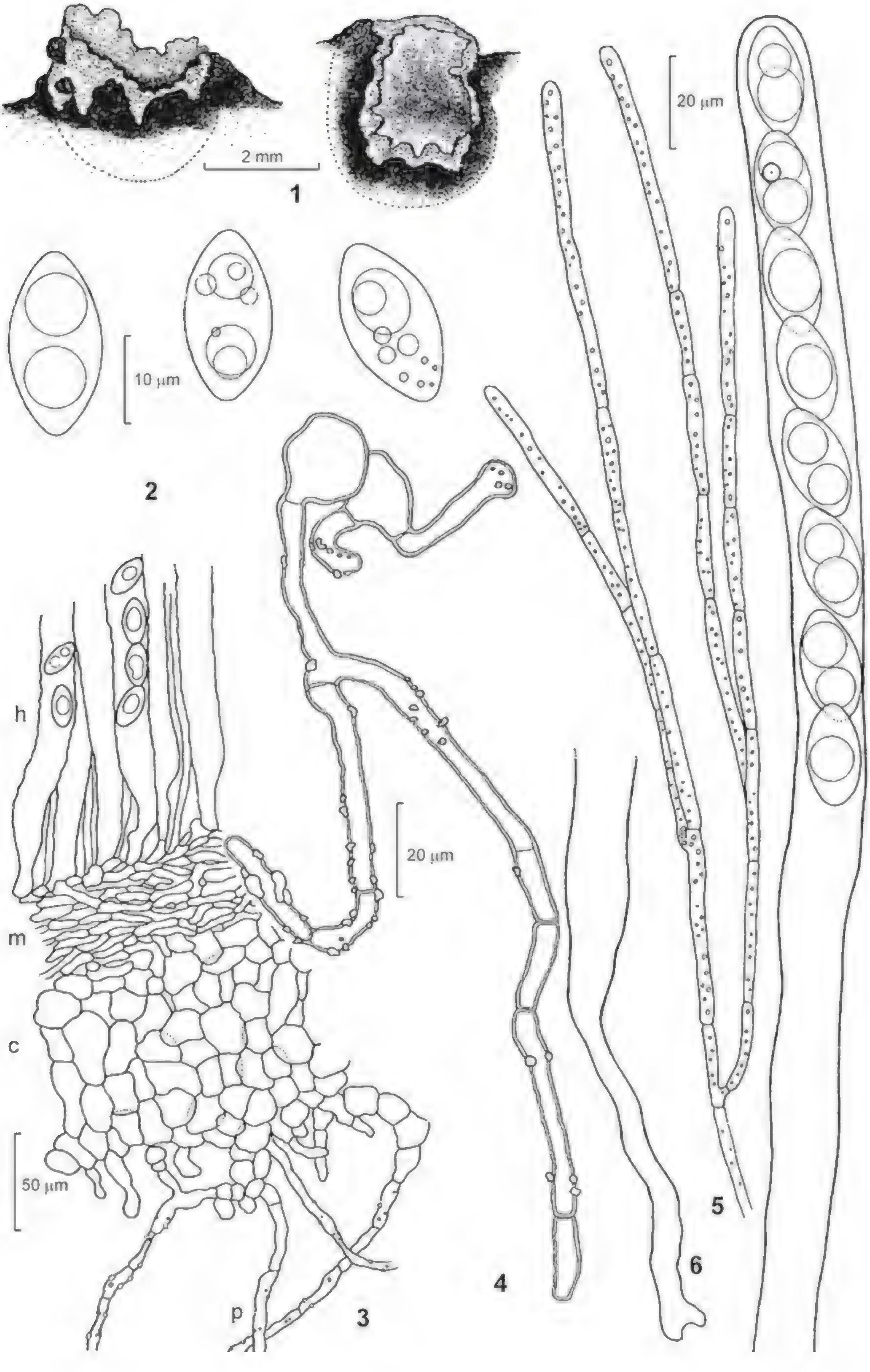
Plate 8. 1–6. *Geopora arenicola* (BAFC 21685). 1. Ascomata: lateral and frontal view. 2. Ascospores. 3. Vertical section of the ascoma: h, hymenium, m, medullary excipulum, c, ectal excipulum, p, hairs. 4. Detail of hairs. 5. Paraphyses. 6. Ascus base and upper portion.


2 mm
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20 µm
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50 µm
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6

thick walled, dark, giving rise to superficial, flexuous, pigmented hairs, ending in obtuse tip (8–14 µm thick), simple or branched, multiseptate. MEDULLARY EXCIPULUM a textura intricata of hyaline, thin walled hyphae. ASCI cylindrical, operculate, 8-spored, J–, arranged in a hymenial layer. PARAPHYSES slender, thin walled, septate, hyaline or slightly swollen at the apex. ASCOSPORES uninucleate, uniseriate, 1- or multiguttulate, containing oil droplets, hyaline, thin-walled, smooth, subglobose to elliptical, sometimes collapsing laterally.

TYPE SPECIES: ***Geopora cooperi*** Harkn., Bull. California Acad. Sci. 1: 168. 1885.

HABITAT: in or on soil, under various species of trees or shrubs.
ANAMORPH: unknown.

NOTES: *Geopora* is here considered in the concept of Burdsall, which contains not only the hypogeous but also the epigeous species included by Boudier in *Sepultaria* (Cooke) Boud. The type species, *G. cooperi,* may be hypogeous as well as epigeous. The position of the ascoma regarding the soil surface, which appears to have evolved independently multiple times within the *Pyronemataceae,* is not considered diagnostic for the genus or phylogenetically significant. Formerly placed in *Tuberales*, *Geopora* was moved by Burdsall to the *Pezizales* (*Pyronemataceae*) because the asci are operculate. The genus is related to *Hydnocystis* Tul. & C Tul. (formerly *Tuberales*, now also *Pezizales*), which has asci without operculum and paraphyses forming an epithecium. *Geopora* is also related to *Trichophaea* (*Pezizales, Pyronemataceae*), which differs in possessing rigid hairs. A molecular study demonstrated that some *Geopora* species are mycobionts forming ectomycorrhiza with coniferous and deciduous trees. The corresponding phylogenetic analysis suggests affinities with *Tricharina.*

DISTRIBUTION IN ARGENTINA: widely distributed in the Northern Hemisphere, only one species is recorded: *Geopora arenicola* (Lév.) Kers, cited as *Sepultaria arenicola* (Lév.) Massee from BA, ME, RN, TF.

ILLUSTRATION: Pl. 8, 1–6. *Geopora arenicola.*

LITERATURE: Boudier 1885; Burdsall 1968; Gamundí 1960, 1975; Korf 1973a; Læssøe & Hansen 2007; Tedersoo et al. 2006; Trappe 1979; Yang & Korf 1985a,b; Yao & Spooner 1996a; Zhang & Yu 1992.

Gyromitra Fr., nom. cons. (*Discinaceae*)

ASCOMATA apothecial, cupulate, discoid, convex to undulate or pileate with pileus irregularly lobed or convoluted, medium-sized to large; superficial, subsessile to distinctly stipitate; solitary or scattered; fleshy consistency, leathery when dry; hymenium yellow-brown, orange-brown, chesnut-brown

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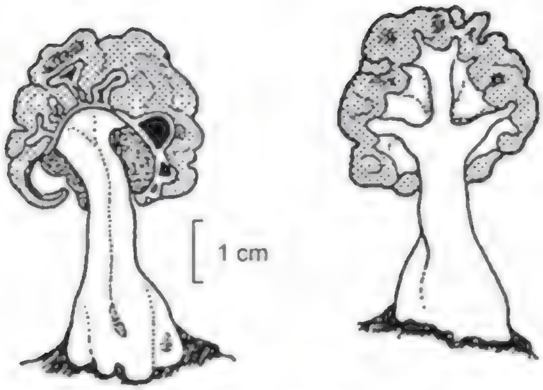
PLATE 9. 1–7. *Gyromitra antarctica* (BAFC 22009). 1. Ascomata. 2. Sketch of a cross section of the pileus: h, hymenium, m, medullary excipulum. 3. Detail of medullary excipulum (m, in FIG. 2). 4. External hyphae from the stipe. 5. Paraphyses. 6. Ascospores. 7. Ascus base and upper portion.



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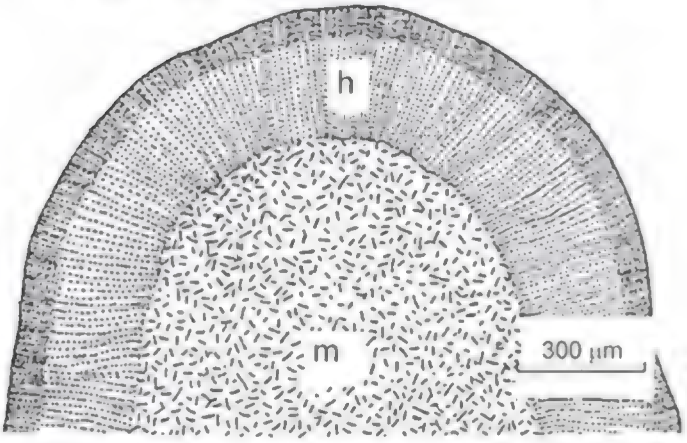

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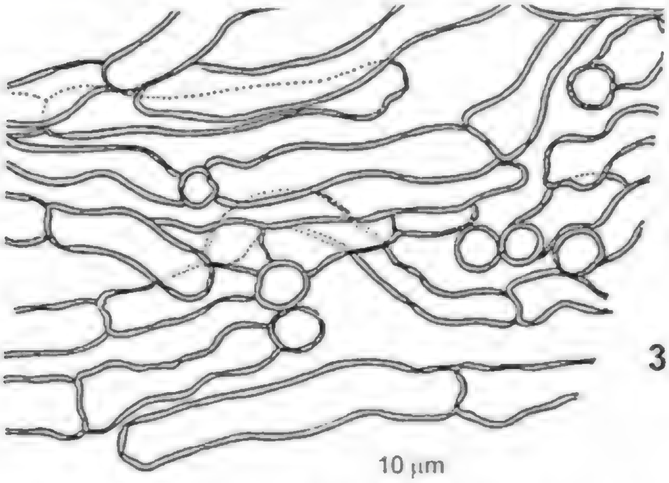

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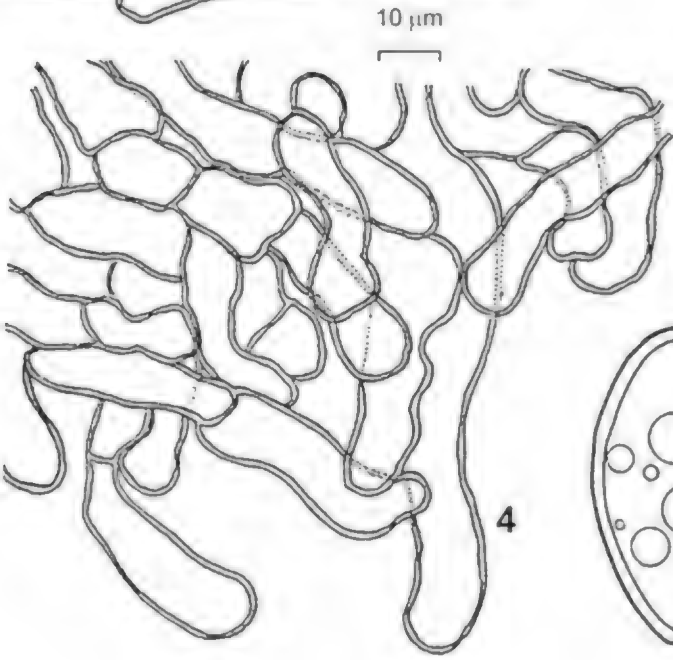

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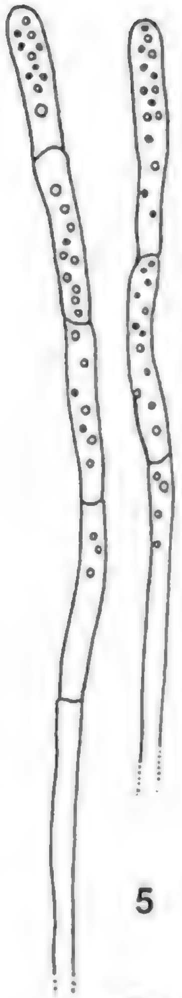

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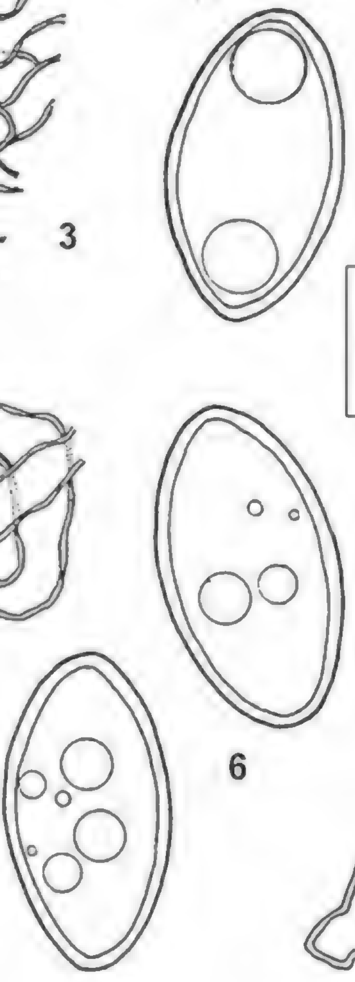

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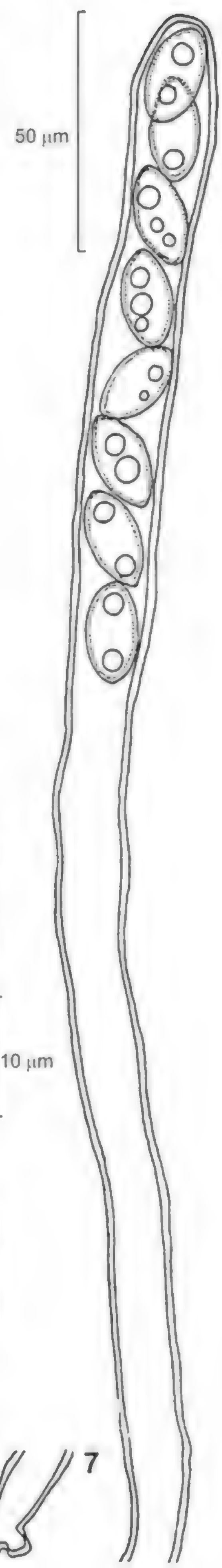

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to dark brown; margin free, recurved; external surface glabrous to pubescent, paler than the hymenium; stipe cylindrical, terete or slightly sulcate, tapering or bulbous near the base, solid, hollow or lacunose, white or with a reddish tinge at the base, glabrous to pubescent. EXCIPULUM entirely of textura intricata at maturity, composed of hyaline, inflated hyphae with septal structure (TEM) showing pores occluded by an electron-dense material and surrounded by elongate Woronin bodies. ASCI cylindrical to subcylindrical, 8-spored, J-. PARAPHYSES straight or forked, robust, slightly enlarged at the apex, with an extracellular incrusted and/or intracellular diffuse reddish brown pigment. ASCOSPORES 4-nucleate, 1–2 seriate, usually containing 1–2 lipid guttules, if 3 the central one larger, hyaline, ellipsoidal to subfusoidal, with or without apiculi at both poles, smooth, verruculose to finely reticulate (SEM), with cyanophilic perispore.

TYPE SPECIES: ***Gyromitra esculenta*** (Pers.) Fr. Summa Veg. Scand., Pars Posterior: 346. 1849.

HABITAT: on soil in deciduous or coniferous forests along path and disturbed areas or on decaying wood, in springtime.

ANAMORPH: unknown.

NOTES: *Gyromitra* is taken here in the wide sense of Harmaja to include *Discina* (Fr.) Fr., *Paradiscina* Benedix, and *Neogyromitra* S. Imai; the first is considered a subgenus distinguished by subsessile, convex ascomata and 3-guttulate, apiculate ascospores, features that Harmaja considered of quantitative value, since the excipulum and ascospore wall structures are similar. TEM study of the origin of ascospore walls in *Gyromitra* showed that apiculum and/or spore wall arise from blebbing of the primary wall material through the epispore into the secondary wall upon which a fibrillar deposit from the perisporic sac forms the ornamentation. It shares with *Helvella* 4-nucleate ascospores with lipid guttules and the septal ultrastructure, but the pileus and excipular structures differ. (See description of *Helvella*). Some species of *Gyromitra* are poisonous due to a heat-labile substance called gyromitrin. *Gyromitra* (false morel or lorchel) also shows affinity with *Morchella* (known commonly as morel, a precious edible mushroom) because of the pileate ascomata. Both coexist in similar habitats in springtime in SW Argentina. The collector should recognize the latter by the typically honeycombed ochre or grey-brown pileus.

DISTRIBUTION IN ARGENTINA: only one species, *G. antarctica* Rehm, is recorded with certainty from the Andean-Patagonian forest from N, RN.

ILLUSTRATION: Pl. 9, 1–7. *Gyromitra antarctica.*

LITERATURE: Abbott & Currah 1997; Benedix 1966, 1969; Eckblad 1968; Gamundí 1960, 1971; Gamundí & Horak 2003; Gamundí et al. 2004; Harmaja 1973, 1976a,b; Häffner 1987; Kimbrough 1994; Kimbrough et al.1990; Kimbrough & Gibson 1991.

Helvella L. (*Helvellaceae*)

Ascomata epigeous, cupulate, auriculoid or pileate with a pileus discoid, saddle-shaped or lobate, rarely sparassoid, small to large, superficial, subsessile to stipitate, solitary, scattered or gregarious, of fleshy consistency; hymenium (disc) whitish to cream coloured, grayish, brown to black; margin free, involute to recurved, undulate, entire to crenate, sometimes with crystalline deposits; external surface glabrous, pubescent to villose, concolorous or paler than the disc; stipe cylindrical, terete or externally sulcate, with longitudinal ribs that may anastomose and invade the receptacle, solid, hollow or lacunose, white, cream coloured or pale grayish to dark gray-brown, glabrous, pubescent to villose. Ectal excipulum of textura prismatica to angularis, composed of doliform cells arranged in rows perpendicular to the surface, the outermost clavate, hyaline or with brownish walls, or aggregated in fascicles. Medullary excipulum a textura intricata of hyaline, branched hyphae, mostly loosely arranged. Asci cylindrical tapered to the base, aporhynchous or pleurorhynchous, 8-spored, J–. Paraphyses straight, cylindrical or slightly enlarged at the apex, hyaline or containing dark brown pigment, pluriseptate. Ascospores 4-nucleate, 1-seriate, usually containing one large lipid guttule, hyaline, broad ellipsoidal to subfusoidal, smooth to verruculose. Stipe in cross section, when it is hollow, shows an extra inner layer like the ectal excipulum.

Type species: ***Helvella crispa*** (Scop.) Fr., Systema Mycologicum 2(1): 14. 1822.

Habitat: on damp sandy, clayish, or rich soils, along paths in deciduous and coniferous forests or artic-alpìne vegetation, occasionally on decaying wood. Anamorph: unknown.

Notes: As a very old name, *Helvella* (or *Elvela*) has been subject to different interpretations and typifications. Modern authors concur in the selection of the type species as presented here. The genus is widely distributed in the Northern Hemisphere and only occasionally collected in Argentina in sites planted with boreal trees. Phylogenetic classifications propose to place it in the family *Helvellaceae*, which includes not only epigeous genera such as *Helvella* but also the related hypogeous *Barssia* Gilkey and *Balsamia* Vittad., formerly placed in the *Tuberaceae*. *Helvella* shares with *Gyromitra* the 4-nucleate ascospores, the same spore wall ontogeny, lipid guttules, and the septal ultrastructure of excipular hyphae (TEM), except that *Helvella* usually has spherical Woronin bodies (see description of *Gyromitra*). *Helvella* is related to *Underwoodia*, which has distinctive ascoma morphology with a pileus completely adnate to stipe and coarsely ornamented ascospores. Earlier authors suggested a synonymy with *Helvella*, but various molecular studies support *Underwoodia* as a separate genus (see also *Underwoodia*). *Wynnella* Boud. is currently considered a synonym of *Helvella*. *Pindara* Vel. has been merged with *Helvella* supported by molecular studies. Several species of *Helvella* have ectomycorrhizal lifestyle. Molecular analyses indicate that they are mycobionts of *Quercus robur* and *Fagus sylvatica.*

Distribution in Argentina: two species, *H. leucomelaena* (Pers.) Nannf. (= *Acetabula nemoralis* Speg.) and *H. leucopus* Pers. have been recorded from BA and N, in gardens and parks.

Illustration: Pl. 10, 1–9. *Helvella leucopus.*

Literature: Abbott & Currah 1988, 1997; Berthet 1964; Dissing 1966; Gamundí 1960; Gamundí & Giaiotti 1998; Harmaja 1974; Häffner 1987; Hansen & Pfister 2006; Kimbrough 1991, 1994; Kimbrough & Gibson 1990; Korf 1973a; Landvik et al. 1999; Nannfeldt 1937; O´Donnell et al. 1997; Tedersoo et al. 2006.

Melastiza Boud. (*Pyronemataceae*)

Ascomata apothecial, medium-sized to large, superficial, sessile, scutellate to cupuliform, scattered to gregarious, bright coloured, disc smooth, plane to concave, orange to red; margin conspicuous, entire or undulate, pruinose to furfuraceous; external surface concolorous with the disc, paler at the base. Ectal excipuluma a textura globulosa to angularis comprising isodiametric cells, smaller towards the surface, sometimes brownish; hairs disposed in tufts, giving the margin and the receptacle a pruinose appearance, short, obtuse, brown-walled, with few septa, arising from superficial cells. Medullary excipulum a textura intricata of densely arranged hyaline hyphae. Asci cylindrical, 8-spored, J– Paraphyses pluriseptate, subclavate or bent at the apex, containing granules of carotenoid pigments (β- and γ- carotene, ester of aleuriaxanthine) that turned green with iodine. Ascospores 1-seriate, uninucleate, 1–2 guttulate, hyaline to pale yellowish, ellipsoidal, with a conspicuous cyanophilic net-like ornamentation, with spiny or hood-like projections at both ends, or with coarse, irregular warts.

Type species: ***Melastiza miniata*** (Fuckel) Boud., Icon. Mycol. Liste Sér. 1[3].

Habitat: on damp, bare, or sandy soil, sometimes among mosses or on burnt places.

Anamorph: unknown.

Notes: According to Korf (1985) the correct name for *M. miniata*, type species of the genus, is *M. cornubiensis* (Berk. & Br.) J. Moravec. *Melastiza chateri* (W.G. Sm.) Boud.) is often found in association with *Aleuria aurantia* in damp and mossy places but can be distinguished easily by the margin and external surface

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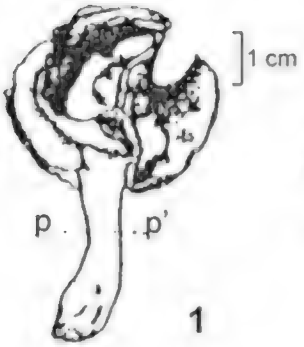
Plate 10. 1–9. *Helvella leucopus* (BCRU 1489). 1. Ascoma. 2. Sketch of a vertical section of the pileus: h, hymenium, sh, subhymenium, em, medullary excipulum, ec, ectal excipulum. 3. Sketch of a cross section of the stipe (p-p´ in fig. 1)): aci, internal ectal excipulum, em, medullary excipulum, ace, external ectal excipulum. 4. Vertical section of the pileus: detail of b in fig 2. 5–6. Detail of a cross section of the stipe (a, b in fig. 3). 7. Paraphyses. 8. Ascus. 9. Ascospores.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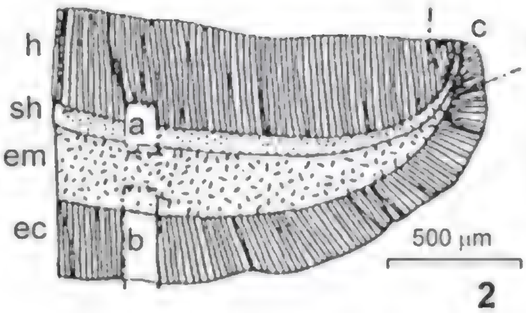
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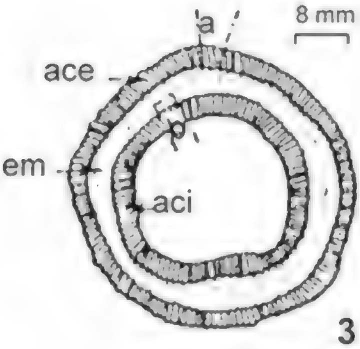
500 µm

2


a
8 mm
ace
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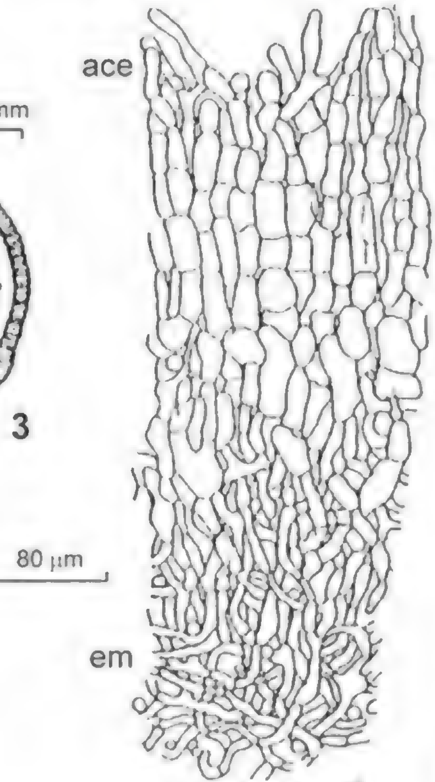
3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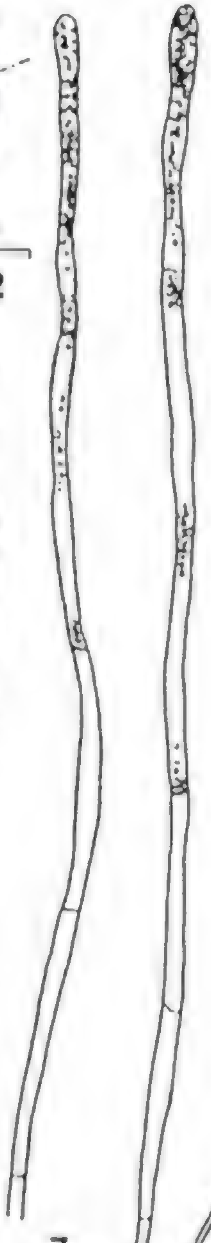
5



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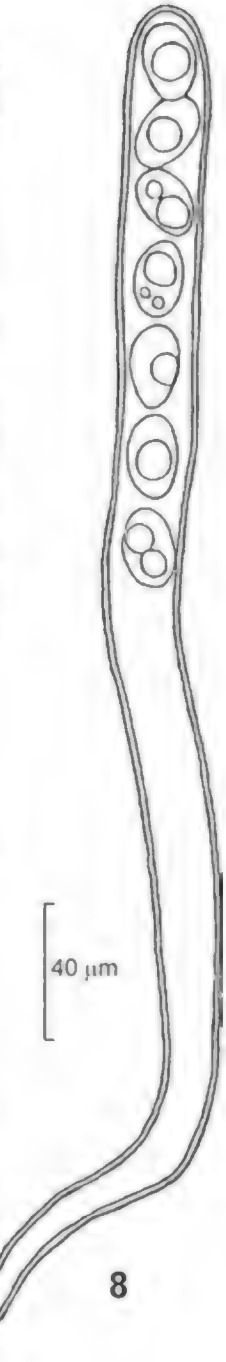
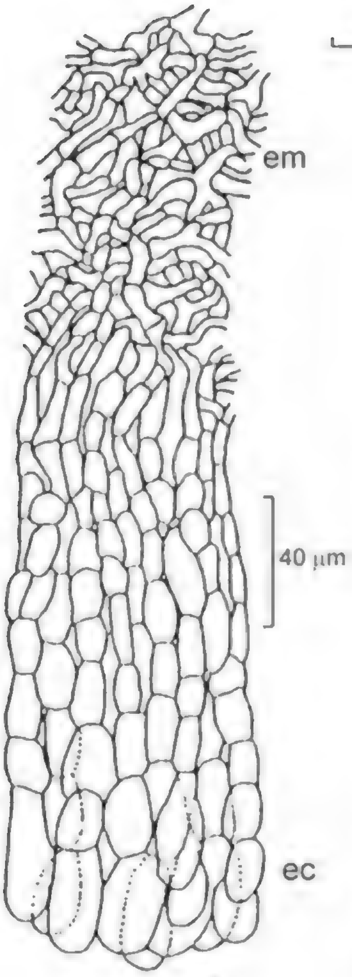

40 µm

8


em
40 µm
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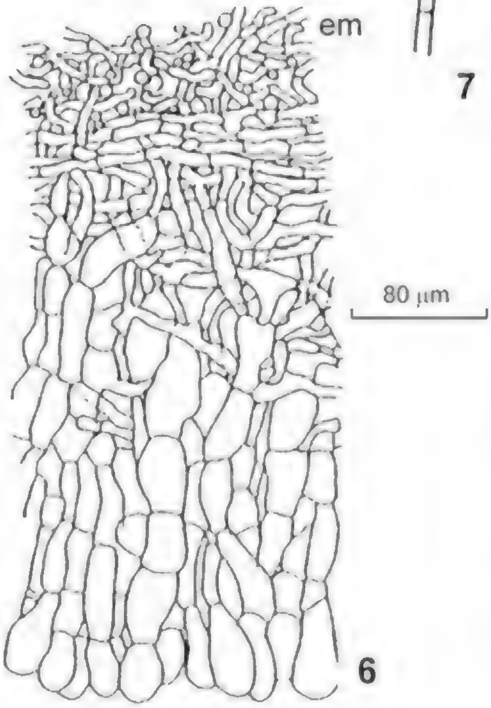
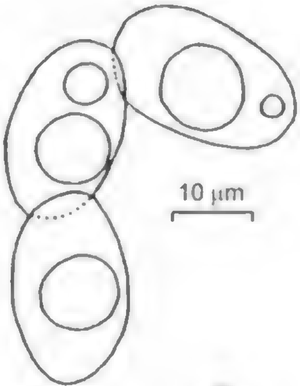
4


em
80 µm

6


10 µm

9

of the ascoma. *Melastiza* is close to *Aleuria* (see Notes under *Aleuria*), as was pointed out by various authors. Moravec united both genera, placing *Melastiza* as a subgenus of *Aleuria*. His viewpoint is supported by: a) the same type of ornamentation; b) the same carotenoid composition in paraphyses (β- and derivates of γ- carotene); and c) the same habitat. He neglected the difference concerning hairy (*Melastiza)* vs. hairless *(Aleuria)* ascomata. The hairy feature and hair morphology is often considered important in distinguishing genera within the *Pezizales* (see treatment of *Cheilymenia* and *Coprobia*), so that some authors accept *Melastiza* as a good genus. We adhere to the view that only species with superficial, dark, blunt hairs belongs to *Melastiza* and others with acuminate hairs should be excluded.

Distribution in Argentina: only *M. chateri* is recorded from TF.

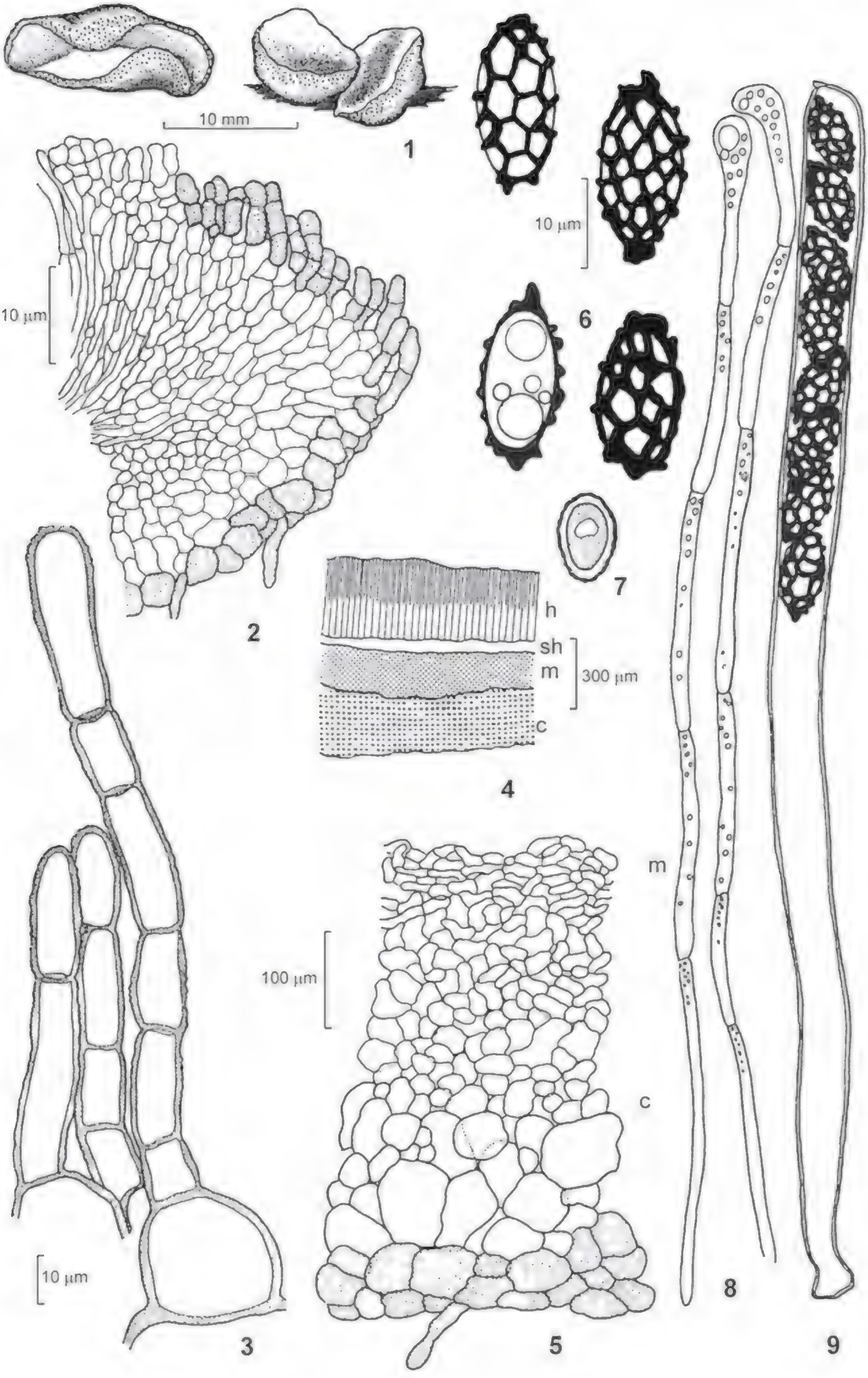
Illustration: Pl. 11, 1–9. *Melastiza chateri.*

Literature: Arpin 1968; Arroyo & Calonge 1988; Dennis 1978, 1986, 1995; Dissing 2000; Gamundí 1975; Gamundí et al. 2004; Korf 1985; Lassueur 1980; Le Gal 1958; Maas Geesteranus 1967; Moravec 1972, 1994a; Rifai 1968; Yao & Spooner 1995a,b.

Morchella Dill. ex Pers. (*Morchellaceae*)

Ascomata pileate, stipitate, large, up to 30 cm high, superficial, gregarious, of fleshy to paperaceous consistency; pileus conical, ovoid to globose, alveolate, alveolae isodiametric or elongate, separated by sterile ribs, giving a honeycomb-like aspect, adnate or separated from the stipe by a shallow groove, or in some species a deep groove; hymenium covering the alveola, ochre, yellow-brown, yellow-orange or grayish-brown, primary ribs concolorous or darker than the hymenium, sterile, longitudinal and anastomosing, sometimes connected with secondary transverse ribs covered by the hymenium; stipe cylindrical or slightly furrowed, bulbous or tapering to the base, hollow, externally glabrous, furfuraceous or scaly, usually whitish or cream, always paler than the pileus. Medullary excipulum of textura angularis, hyaline. Stipe comprising a cortical layer of textura globulosa to angularis composed of hyaline cells, the most external cylindrical, aggregated in tufts to form furfurations or scales and a inner layer of textura intricata, hyaline. Asci cylindrical, 8-spored, thin walled, J–. Paraphyses robust, straight or curved, capitate, clavate or irregularly enlarged at the apex, diffusely pigmented. Ascospores 1-seriate, multinucleate, at maturity eguttulate, after puffing with external, polar guttules, hyaline to subhyaline, ellipsoidal to subfusoidal, smooth or with delicate longitudinal striation (SEM). Spore print yellowish to orange-pinkish.

Plate 11. 1–9. *Melastiza chateri* (BAFC 21982). 1. Ascomata. 2. Marginal excipulum. 3. Detail of hairs. 4. Sketch of a vertical section of the ascoma: h, hymenium, sh, subhymenium, m, medullary excipulum, c, ectal excipulum. 5. Detail of the excipulum: m and c, as in fig. 4. 6. Mature ascospores in surface view and optical section. 7. Immature ascospore. 8. Paraphyses. 9. Ascus.


10 mm
1
10 µm
2
10 µm
6
7
h
sh
m
300 µm
c
4
m
100 µm
c
10 µm
3
5
8
9

TYPE SPECIES: ***Morchella esculenta*** (L.) Pers., Syn. Meth. fung. 2: 618. 1801.

HABITAT: on calcareous or sandy soils in conifer/deciduous forests or in nearby prairies, disturbed places mixed with charcoal, in orchards or gardens. Saprotrophs and ectomycorrhizal.

ANAMORPH: ***Costantinella*** Matr. Conidiophores mononematose, hyaline, conidiogenous cells disposed in whorls, strongly recurved, denticulate; conidia hyaline, sympodioblastic, globose to subglobose.

NOTES: *Morchella* as here understood includes *Mitrophora* Lév., which differs only in having a deep groove separating the cap from the stipe. As a genus *Morchella* is easily identified by its honeycombed pileus but difficult to define due to the uniformity of microscopic features and the variation of morphotypes in nature. In their enzyme-linked immunoabsorbent assay of *Morchella esculenta* complex, for instance, Jung et al. (1993) concluded that immunologically distinguishable forms do produce easily distinguishable morphotypes.(e.g. *M. esculenta*). One proposed classification considers three sections (*Adnatae, Semiadnatae, Distantes*) based on the macroscopic separation of pileus and stipe. *Morchella* shares a pileate ascoma with *Helvella* but differs in the microstructure of the pileus and multinucleate ascospores (see description of *Helvella*). Different also is *Verpa* Sw., which has a campanulate, longitudinally furrowed or reticulate pileus with a free margin and 2–8 ascospores. Molecular generated phylogenies suggest that *Morchella, Verpa,* and *Disciotis* Boud. comprise a clade that is sister to *Gyromitra–Hydnotrya.* Some species form sclerotia in nature and in vitro. Ectomycorrhizae have been demonstrated between some species of *Morchella* and conifers *(Abies, Picea, Pinus*). It has been suggested that in nature *Morchella* spp. follow two ecological strategies — either pioneer saprotrophs and ephemeres on disturbed soils or perennial ectomycorrhizals with vascular plants in forests. In both cases they form sclerotia in winter. Fructification in vitro was first reported by Ower and registered as a US Patent. Later a life cycle could be reproduced from ascospores to ascomata suggesting two alternate pathways, via a) primary mycelium that may form a sclerotium that after overwintering can produce an ascoma or b) crossing two compatible primary mycelia that after plasmogamy form a heterokaryotic secondary mycelium that may produce a sclerotium that finally forms the ascoma. Sclerotia in vitro derived from polysporic cultures have been observed in *Morchella* spp. associated with *Austrocedrus chilensis* in Argentina

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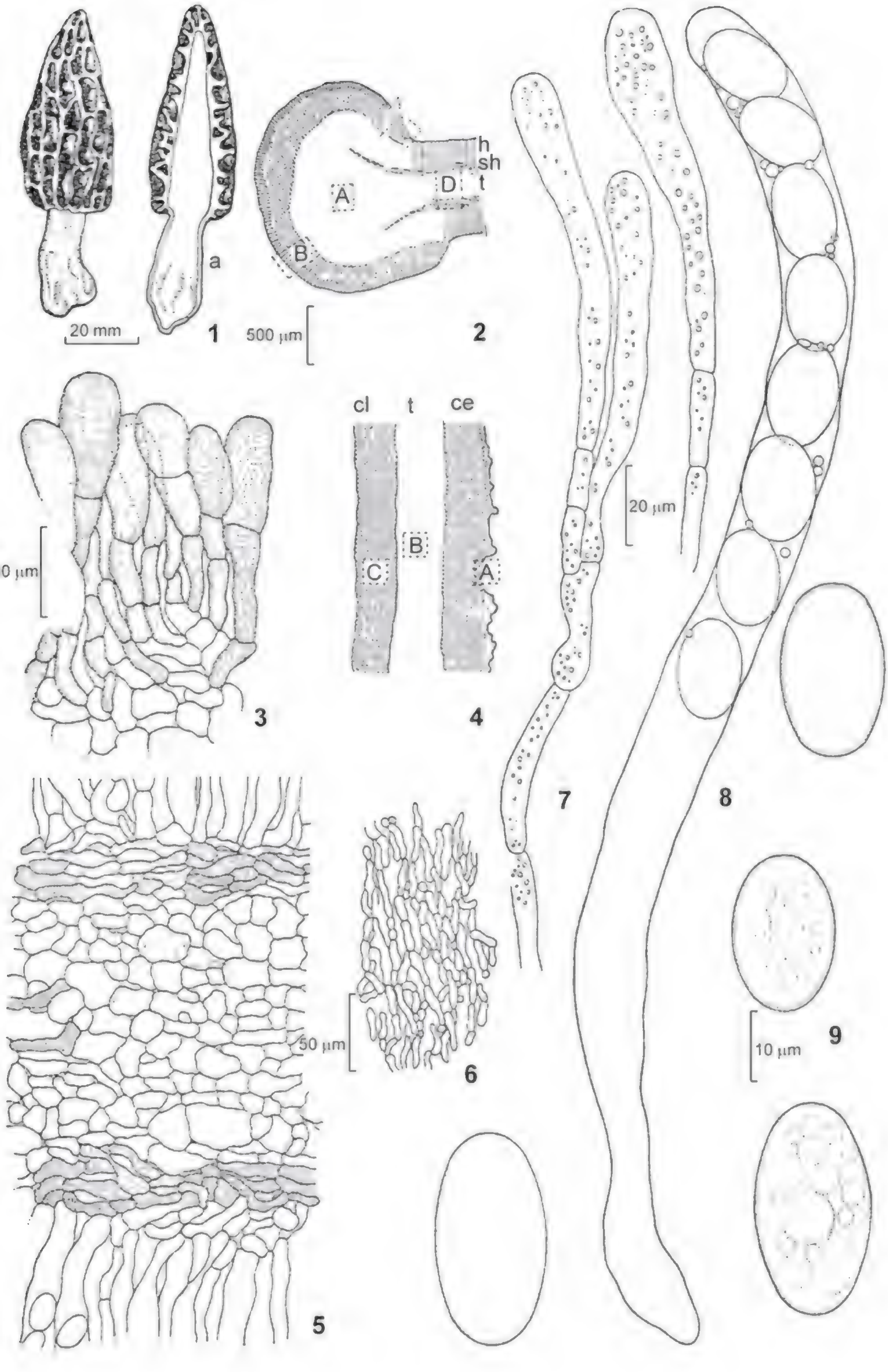
PLATE 12. 1–9. *Morchella elata* (LPS 35912). 1. Ascomata: a, in vertical section. 2. Sketch of a cross section of the pileus: h, hymenium, sh, subhymenium, t, medullary excipulum, A–B, rib. 3. Detail of B in FIG. 2. 4. Sketch of a longitudinal section of the stipe: ce, cortical layer, t, trama, ci, internal layer. 5. Detail of the D in FIG. 2. 6. Detail of B in FIG. 4. 7. Paraphyses. 8. Ascus. 9. Ascospores.


a
20 mm
1
h
sh
t
D
A
B
500 μm
2
50 μm
3
cl
t
ce
B
C
A
4
5
50 μm
6
20 μm
7
8
10 μm
9

(unpublished results). Spawn and a kit for outdoors cultivation of *Morchella* spp. are now commercially available.

DISTRIBUTION IN ARGENTINA: Five species are recorded in Argentina: *M. esculenta*, *M. intermedia* Boud., *M. elata* Fr., *M. patagonica* Speg., *M. semilibera* DC. from CO, N, RN, TF. There are several unidentified collections preserved in LPS and BCRU.

ILLUSTRATION: Pl. 12, 1–9. *Morchella elata.*

LITERATURE: Boudier 1897; Buscot 1992, 1993; Buscot & Kottke 1990; Dahlstrom et al. 2000; Dissing 2000; Domínguez de Toledo 1987; Eckblad 1968; Hennebert & Bellemère 1979; Jung et al. 1993; Gamundí 1975; Gamundí & Horak 2003; Jacquetant 1984; Landvik et al. 1997; O´Donnell et al. 1997; Ower 1982; Paden 1972; Parguey-Leduc et al. 1998; Rifai 1968; Volk & Leonard 1990.

Nothojafnea Rifai (*Pyronemataceae*)

ASCOMATA apothecial, small- to medium-sized, superficial, subsessile, gregarious, cup shaped; disc deeply concave, reddish brown to dark brown; external surface brown to reddish brown paler than the disc, felty; hairs short, slender, pauciseptate, straight or curved, hyaline or subhyaline, sometimes with a brownish sap. ECTAL EXCIPULUM a textura angularis of isodiametric or polygonal light brown cells disposed at right angle to the surface, some superficial cells clavate, thick walled, containing brownish sap. MEDULLARY EXCIPULUM of compact textura intricata, composed of hyaline, slender hyphae running horizontally. ASCI subcylindrical, rather thick walled, 8-spored, J–. PARAPHYSES subclavate, simple, containing brownish pigment at the apex, pluriseptate. ASCOSPORES 1-seriate, hyaline, when young multiguttulate, ellipsoidal, ornamented with small warts weakly stained with lactic blue.

TYPE SPECIES: ***Nothojafnea cryptotricha*** Rifai, Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk. 2de Reeks, 57(3): 94. 1968.

HABITAT: on soil.
ANAMORPH: unknown.

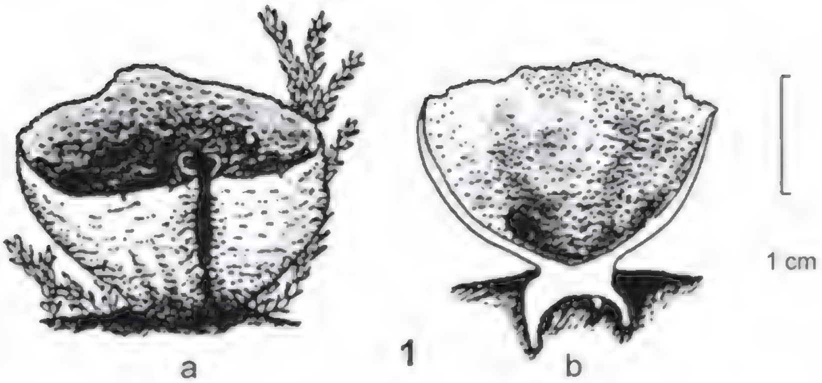
NOTES: *Nothojafnea* is close to *Jafnea.* The latter genus differs in having brown-walled hairs and fusoidal to fusiform-ellipsoidal ascospores. It is also distinct from *Aleurina* in ascospores and hairs. (See description of *Aleurina.*)

DISTRIBUTION IN ARGENTINA: Only one species is recorded: *N. thaxteri* (Cash) Gamundí from CH, N and RN.

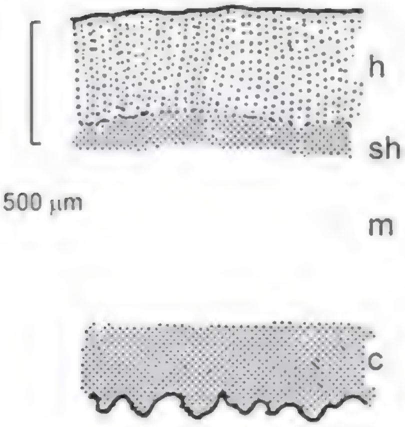
ILLUSTRATION: Pl. 13, 1–6. *Nothojafnea thaxteri.*

LITERATURE: Eckblad 1968; Gamundí 1972a, 1999; Gamundí et al. 2004; Korf 1960, 1973a; Rifai 1968; Zhuang & Korf 1986.

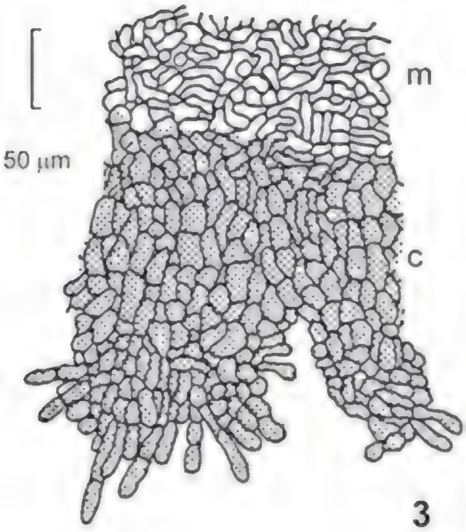
PLATE 13. 1–6. *Nothojafnea thaxteri* (BAC 5838). 1. Ascomata: a, side view, b, vertical section. 2. Sketch of a vertical section of the ascoma: h, hymenium, sh, subhymenium, m, medullary excipulum, c, ectal excipulum. 3. Detail of the excipulum: m, c, as in FIG. 2. 4. Ascospores: a, optical section, b, surface view. 5. Hairs of the ectal excipulum. 6. Ascus and paraphyses.



1


h
sh
500 µm
m
c

2



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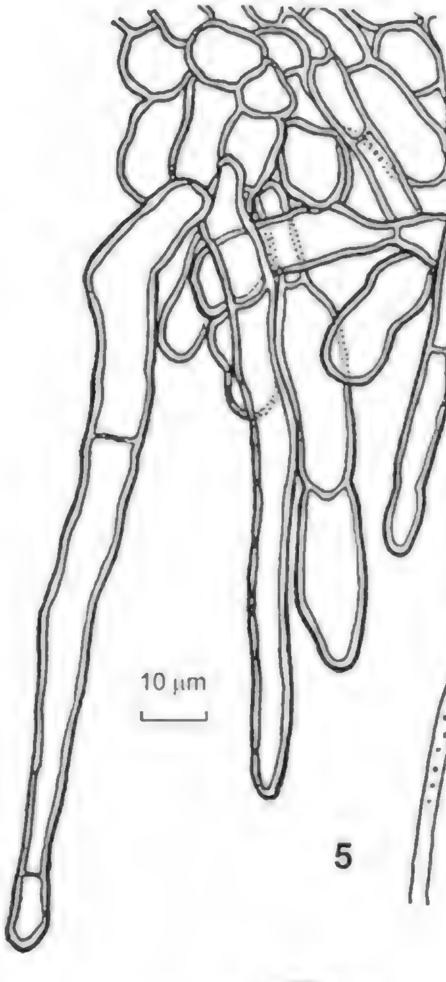

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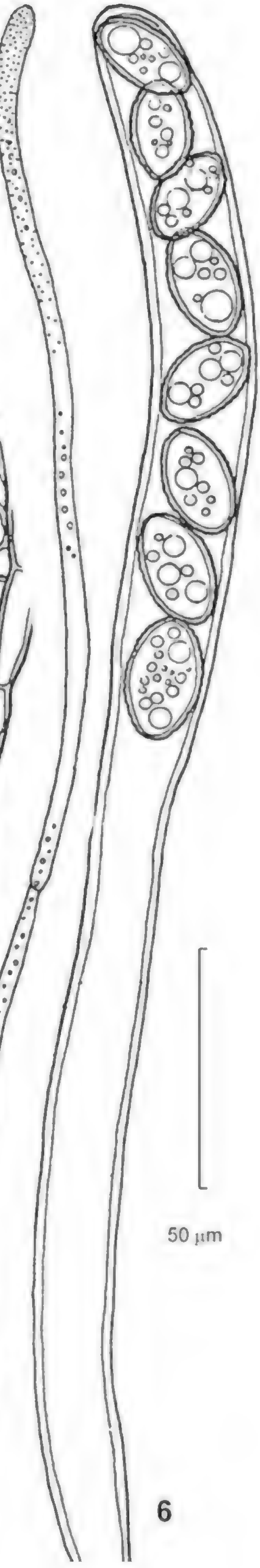

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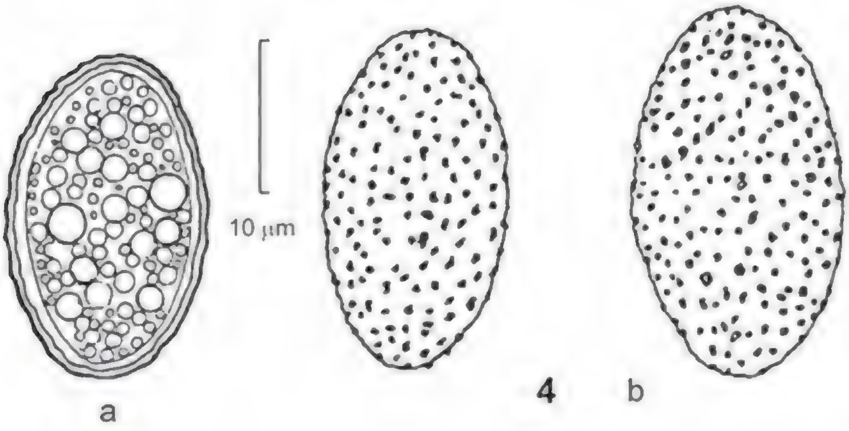


4

Phillipsia Berk., nom. cons. (*Sarcoscyphaceae*)

ASCOMATA apothecial, small to large, cup shaped, sometimes asymmetrical, superficial, sessile, subsessile to stipitate, scattered to gregarious, usually bright coloured; disc shallow or deeply concave, smooth or umbilicate, in several shades of orange, pink, reddish, yellow, purplish or brownish violet; exterior furfuraceous to tomentose, paler than the disc, consisting of simple, hyphal, flexuous, superficial, hyaline hairs. ECTAL EXCIPULUM, thin, a textura porrecta to intricata of hyaline hyphae, running more or less parallel to the surface of the receptacle. MEDULLARY EXCIPULUM well developed, of loose textura intricata. ASCI cylindrical to subcylindrical, suboperculate, thick walled, gradually attenuated towards the base, 8-spored, J–. PARAPHYSES pluriseptate, filiform, straight, hyaline, simple or branched, sometimes anastomosing with each other, containing carotenoids (major pigment phillipsiaxanthine). ASCOSPORES 1-seriate, multinucleate, containing 1–2 guttules, hyaline to pale yellowish, ellipsoidal with acute ends to subapiculate, inaequilateral, with longitudinal ridges that occasionally anastomose or wrinkled, and ornamentation arising from the primary wall, cyanophobic.

TYPE SPECIES: ***Phillipsia domingensis*** (Berk.) Berk., J. Linn. Soc., Bot. 18: 388. 1881.

HABITAT: on fallen angiosperm branches or wood.

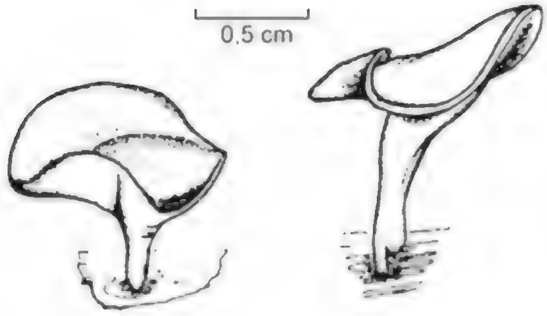
ANAMORPH: ***Molliardiomyces*** Paden. Germinating ascospores produce conidiophores with conidiogenous cells with sympodial or percurrent proliferation, conidia holoblastic, subglobose, hyaline.

NOTES: *Phillipsia* shows a great variability in disc colour, which in the same species can vary, for example, from deep pink to whitish. Some species contain a particular carotenoid pigment, phillipsiaxanthin. The genus is close to *Cookeina* in sharing similar ascospore ornamentation, suboperculate ascus apex, and the same major pigment but differing in other characters (see NOTES under *Cookeina*).

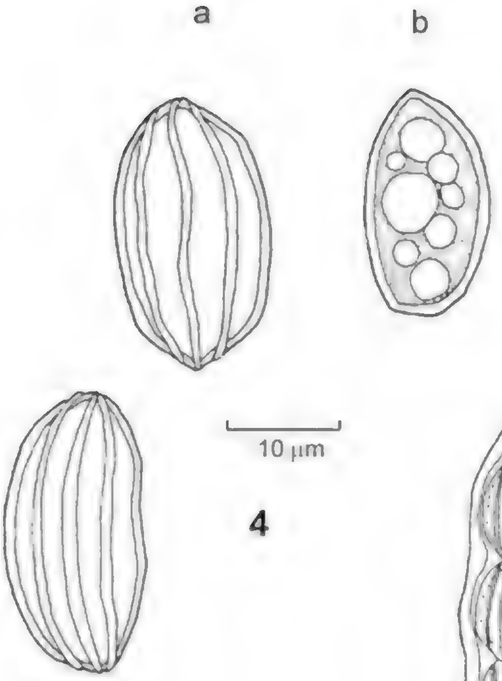
Nanoscypha Denison, also with a *Molliardiomyces* anamorph, differs in excipular structure and 4-spored asci. *Sarcoscypha* (Fr.) Boud. differs in its equilateral, subcylindrical, and always smooth ascospores. The type of ascospore germination is similar to *Sarcoscypha*.

ITS-based molecular studies of *Phillipsia* imply four main lineages that are supported by ascospore morphology: 1) the *P. domingensis* complex, which includes ascospores ornamented with separate and few longitudinal ridges;

PLATE 14. 1–7. *Phillipsia domingensis* (BAFC 30278). 1. Ascomata. 2. Sketch of a vertical section of the ascoma in the basal zone: m, medullary excipulum, c, ectal excipulum, t, tomentum. 3. Detail of a section of the ascoma at the lateral zone: m and c, as in FIG. 2. 4. Ascospores: a, surface view; b, optical section. 5. Detail of a vertical section of the ascoma at the basal zone: m, c, and t, as in fig 2. 6. Paraphyses. 7. Ascus.



1



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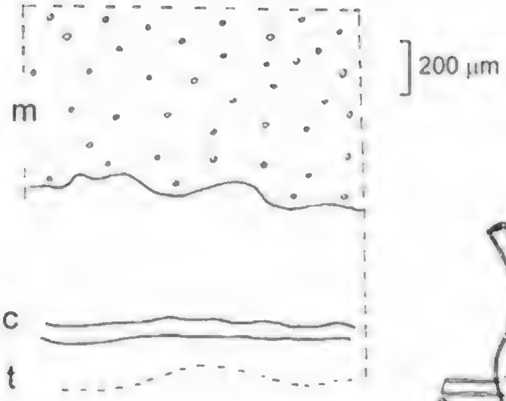

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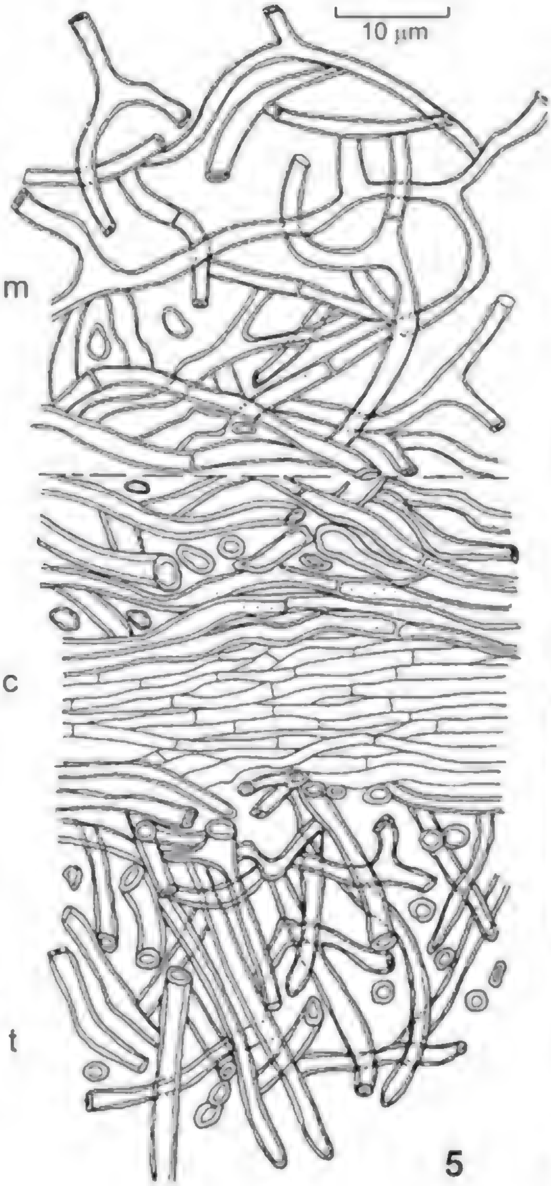

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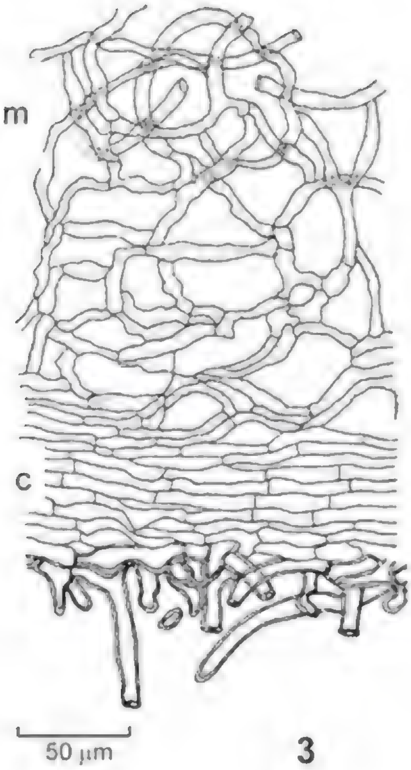

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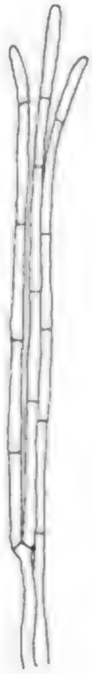

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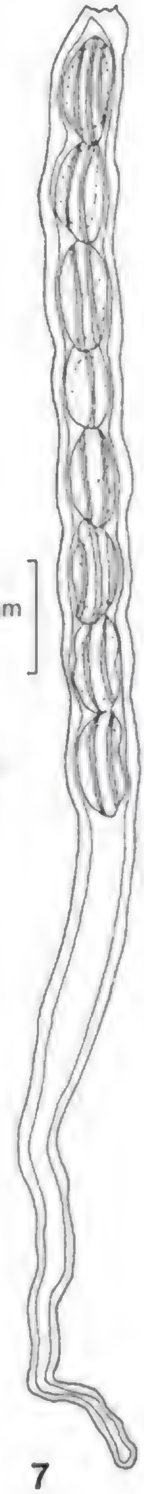

7

2) *P. olivacea*, with smooth or wrinkled ascospores; 3) *P. crispata*, with fine, profuse longitudinal, parallel ridges; and 4) *P. carnicolor* Le Gal with broad, irregular, longitudinal ridges sometimes anastomosing. It is suggested that colour of the ascomata should be used with caution as a taxonomic character. The genus is pantropical, reaching subtropical areas.

DISTRIBUTION IN ARGENTINA: four species have been recorded: *P. domingensis*, *P. hartmannii* (W. Phillips) Rifai, *P. crispata* (Berk. & M.A. Curtis) Le Gal and *P. olivacea* Rick (the last cited as *P. rugospora* Paden) from M, T.

ILLUSTRATION: Pl. 14, 1–7. *Phillipsia domingensis.*

LITERATURE: Arpin 1969; Boedijn 1933; Cabello 1988; Denison 1969, 1972; Hansen et al. 1999; Harrington et al.1999; Kirk et al. 2008; Le Gal 1953; Li & Kimbrough 1996b; Paden 1974, 1977, 1984, 1986; Romero & Gamundí 1986; Zhuang & Wang 1998.

Plectania Fuckel (*Sarcosomataceae*)

ASCOMATA apothecial, medium-sized to large, cup shaped, superficial, sessile to substipitate, scattered to gregarious, of tough gelatinous consistency; disc deeply concave, dark brown to black, smooth, gelatinous, drying cracked; external surface felty to tomentose, dark or a little paler than the disc, venose near the base. ECTAL EXCIPULUM thin, a textura globulosa to angularis of isodiametric, brown-walled cells ending in flexuous, brown, thick-walled, densely intertwined hairs. MEDULLARY EXCIPULUM of a loose textura intricta, well developed, composed of hyaline, branched, septate hyphae embedded in a gelatinous matrix. ASCI cylindrical, thick-walled, contracted below forming an apendiculate base, with a central operculum, 8-spored, J–. PARAPHYSES filiform, pluriseptate, sometimes profusely branched near the apex and anastomosing, forming a delicate net, hyaline or containing a diffuse pigment. ASCOSPORES 1-seriate, multinucleate, hyaline to pale yellowish, containing many guttules, ellipsoidal to asymmetrically fusoidal or suballantoid, smooth or covered by non-cyanophilic transverse ridges on the convex side that occasionally anastomose.

TYPE SPECIES: ***Plectania melastoma*** (Sowerby) Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 324. 1870.

HABITAT: on twigs, plant debris, decaying logs, sometimes covered with mosses, in coniferous and deciduous forests.

ANAMORPH: ***Conoplea*** Pers. Conidiomata synnematous, pulvinate, sometimes with a stromatic base or groups of conidiophores mononematous scattered on the

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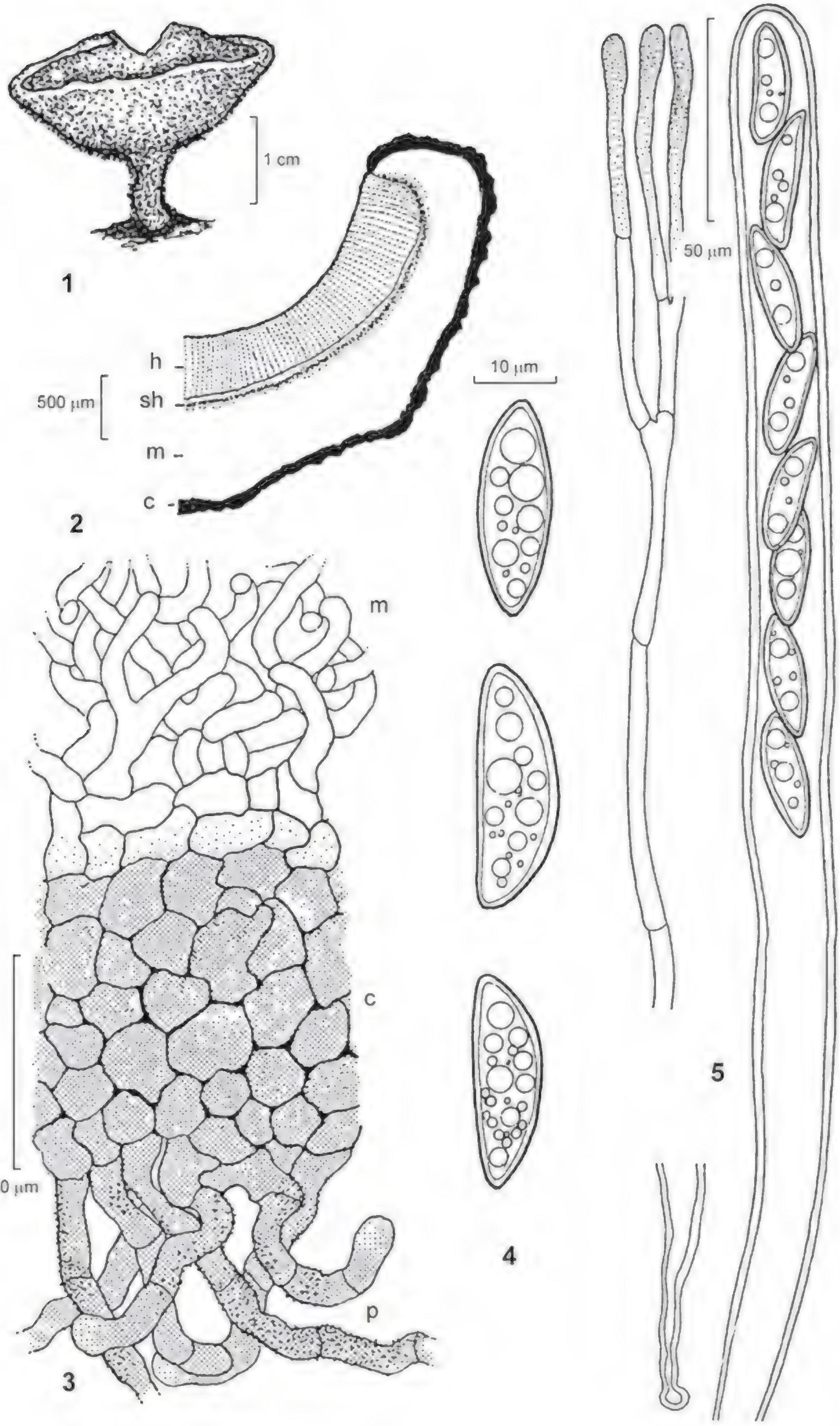
PLATE 15. 1–5. *Plectania chilensis* (Lazo Pu-28). 1. Ascoma. 2. Sketch of a vertical section of the ascoma: h, hymenium, sh, subhymenium, m, medullary excipulum, c, ectal excipulum. 3. Detail of the excipulum, m and c, as in FIG. 2, p, hairs. 4. Ascospores. 5. Ascus base and upper portion and paraphyses.


1 cm
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500 µm
m
c
2
m
c
50 µm
p
3
10 µm
4
50 µm
5

substratum; conidiophores geniculate, arborescent, brownish; conidiogenous cells sympodioblastic; conidia holoblastic, unicellular, globose to ellipsoidal, brownish, smooth or verrucose, with a slit or pore.

NOTES: According to modern authors, *Plectania* is related to *Urnula* Fr., which also has black, large ascomata but lacks the gelatinous medullary excipulum. Ultrastructural studies (TEM) comparing ascus walls of the *Plectania* and *Urnula* type species show that they have a similar structure. *Pseudoplectania* Fuckel, which is perhaps another close genus, has globose ascospores, with different ontogeny of the walls, as demonstrated by ultrastructural studies (TEM). The mature ascospore wall in *Plectania* is composed of primary wall, epispore, and secondary wall, while *Pseudoplectania* lacks the secondary wall. *Sarcosoma* Casp. differs in its highly gelatinous, turbinate ascomata. *Galiella* Nannf. & Korf is distinguished by ascospore walls with cyanophylic ornamentation. SSU rDNA and 18S r RNA sequence-based analyses support all genera mentioned above in the *Sarcosomataceae*, a monophyletic or paraphyletic family different from the *Sarcoscyphaceae*, as previously suggested from ultrastructure (TEM) of the ascus-wall layers.

DISTRIBUTION IN ARGENTINA: two species are recorded: *P. chilensis* (Mont.) Gamundí and *P. rhytidia* (Berk.) Nannf. & Korf from: BA, CH, M, N, RN.

ILLUSTRATION: Pl. 15, 1–5.*Plectania chilensis.*

LITERATURE: Bellemère et al. 1990; Benkert 2005; Cabello 1988; Dissing 2000; Donadini 1985; Eckblad 1968; Gamundí 1971; Gamundí & Giaiotti 1998; Gamundí et al. 2004; Harrington et al. 1999; Hughes 1960; Korf 1957, 1973a; Le Gal 1953; Landvik et al. 1997; Li & Kimbrough 1995; Liu & Zhuang 2006; Paden 1972; Rifai 1968; Romero & Gamundí 1986; Sutton & Hennebert 1994.

Rhodopeziza Hohmeyer & J. Moravec (*Pezizaceae*)

ASCOMATA apothecial, medium-sized to large, superficial, sessile to subsessile, cupuliform to cochleate; margin pruinose; disc smooth, concave sometimes undulate, orange reddish (*miniatus)*; margin conspicuous, pruinose; external surface smooth. ECTAL EXCIPULUM of textura angularis to textura globulosa, composed of cells larger than the medullary cells. MEDULLARY EXCIPULUM a textura globulosa to angularis of cells occasionally intermixed with hyphae. ASCI cylindrical, operculate, 8-spored, the whole wall turning blue with iodine (J+). PARAPHYSES simple, pluriseptate, subclavate and bent towards the apex, containing granules of a carotenoid pigment, that turns green with iodine. ASCOSPORES, 1-seriate, with one evanescent guttule, hyaline to pale yellowish,

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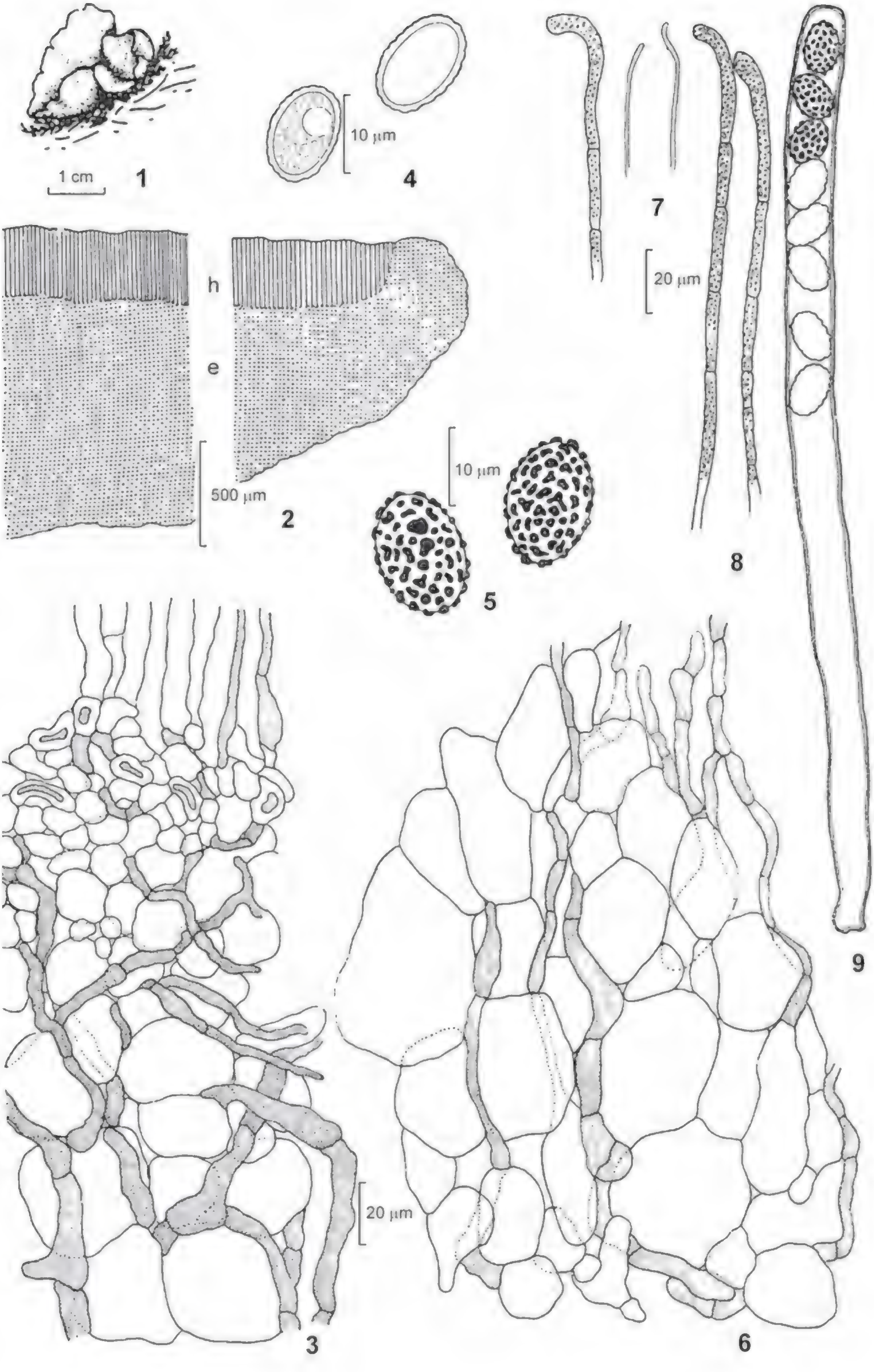
PLATE 16. 1–9. *Rhodopeziza tuberculata* (LPS 37095). 1. Ascomata. 2. Sketch of a vertical section of the ascoma: h, hymenium, e, excipulum. 3. Detail of the excipulum in the internal zone. 4. Immature ascospores. 5. Mature ascospores. 6. Detail of the excipulum in the external zone. 7. Dehiscent ascus. 8. Paraphyses. 9. Ascus.


1 cm
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7
20 µm
h
e
500 µm
2
10 µm
5
8
9
20 µm
3
6

broadly ellipsoidal, tuberculate, with tubercules isolated, conical to truncate, conspicuously cyanophilic.

TYPE SPECIES: ***Rhodopeziza tuberculata*** (Gamundí) J. Moravec & Hohmeyer, Czech Mycol. 47(4): 261. 1995 ["1994"].

HABITAT: on soil, among liverworts.
ANAMORPH: unknown.

NOTES: *Rhodopeziza* is very similar to *Aleuria* (*Pyronemataceae*), both macroscopically and microscopically, sharing a brightly coloured hymenium (due to a carotenoid pigment in the paraphyses), subhymenium, and excipular structure. Main differences are the tuberculate (instead of reticulate) ascospores and a weak J+ reaction of the entire ascus wall (compared to J– in *Aleuria*). This character led Hohmeyer and Moravec to create the monotypic genus *Rhodopeziza*. On the other side, if we emphasize the character of carotenoid pigment plus the diffuse iodine reaction of the ascus wall, the closest genus would be *Iodophanus* Korf (*Pezizaceae*). Moravec placed *Rhodopeziza* in the *Pezizales*. Eriksson and Hawksworth, based on the presence of iodine positive asci, decided to incorporate the genus into the *Pezizaceae* while referring *Aleuria* to the *Pyronemataceae*. A J+ ascus wall is currently accepted as a phylogenetically more important character than the pigmentation of the hymenium. It would be desirable to collect the type species again to confirm the iodine positive ascus wall as a character that defines the taxonomic position of the genus.

DISTRIBUTION IN ARGENTINA: *R. tuberculata* was only found in TF cited as *Aleuria tuberculata* Gamundí. It has not been reported elsewhere in the world.

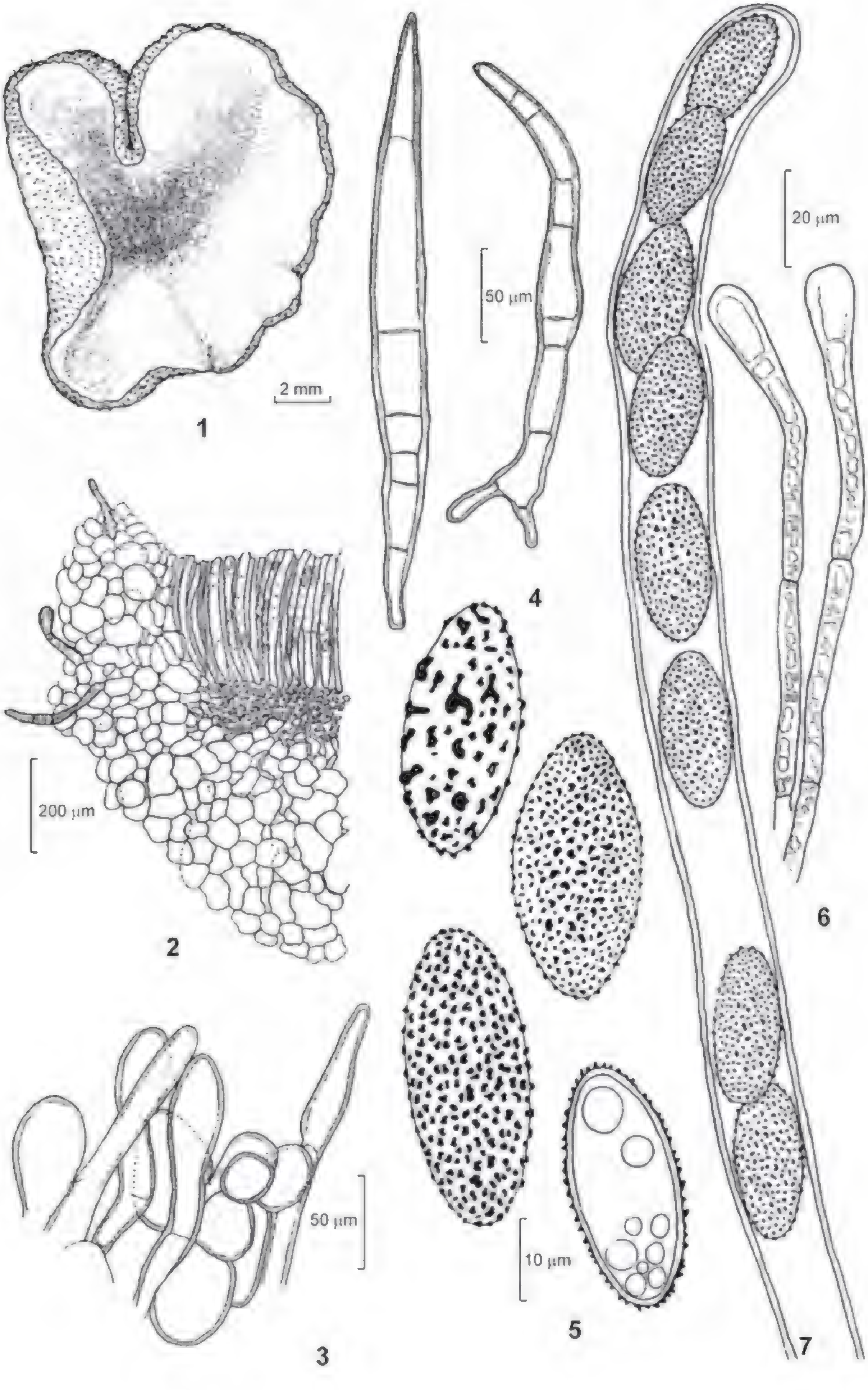
ILLUSTRATION: Pl. 16, 1–9. *Rhodopeziza tuberculata.*

LITERATURE: Eriksson & Hawksworth 1995; Gamundí 1975; Gamundí et al. 2004; Hansen et al. 2001; Häffner 1993; Moravec 1994b.

Scutellinia (Cooke) Lambotte, nom. cons. (*Pyronemataceae*)

ASCOMATA apothecial, small- to medium-sized, superficial, sessile, saucer-shaped, gregarious, usually bright coloured; disc smooth to undulate, from orange, red, to reddish-brown, exceptionally white; margin and external surface hairy, ochraceous to brownish; hairs setose, simple, brown to brownish black, multiseptate, with thick lateral walls, thin septa and forked bases arising deeply from the excipulum, up to 3000 µm long, the marginal hairs longer than the lateral; superficial hairs shorter, brownish, simple, rarely bifurcate at the base. ECTAL EXCIPULUM of textura angularis to textura globulosa. MEDULLARY EXCIPULUM of textura intricata, with hyphae densely arranged horizontally.

PLATE 17. 1–7. *Scutellinia doelloi* (LPS 35716). 1. Ascoma. 2. Vertical section of the ascoma. 3. Detail of the margin. 4. Setose hairs. 5. Ascospores. 6. Paraphyses. 7. Ascus: upper portion.


2 mm
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50 µm
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7

Asci cylindrical, operculate, usually 8-spored, less commonly 2–4 spored, J–. Paraphyses multiseptate, straight, club-shaped to pear-shaped at the apex, usually containing granules of carotenoid pigments—major pigment γ-carotene—that turn green in iodine and blue in sulphuric acid in fresh material. Ascospores 1-seriate, uni- to multinucleate, uni- to multiguttulate, globose, ellipsoidal to subfusoidal, hyaline to pale yellowish, ornamented with warts, spines, ridges or a reticulum intensely dying with lactic-blue (cyanophilic), rarely smooth.

Type species: ***Scutellinia scutellata*** (L.) Lambotte, Mém. Soc. Roy. Sci., Liège, sér. 2, 1: 199. 1887.

Habitat: on soil, wood and plant debris, in wet places, sometimes associated with mosses and liverworts.

Anamorph: unknown.

Notes: *Scutellinia* is taken in the sense of modern authors to replace *Lachnea* (Fr.) Gillet (typified by an inoperculate discomycete) and *Ciliaria* Quél. (an illegitimate name). The name *Patella* F.H. Wigg. was rejected after Korf & Schumacher's (1986) proposed to designate *Scutellinia* a nomen conservandum. *Scutellinia* is related to *Cheilymenia,* which has also rooting hairs (which can be either brown or hyaline in that genus). Recent nLSU rDNA sequence analyses suggest affinity between these genera, which TEM studies on septal pores also support. (See Notes under *Cheilymenia.*)

Scutellinia differs from *Anthracobia*, which has blunt, non-rooting hairs and biguttulate ascospores. Cultures in PDA may produce mycelium with brown, monilioid chlamydospore chains. Germinating ascospores may give rise to microconidia. According to substrata, they have been classified in three ecological groups: humus saprotrophs, xylosaprotrophs, and forest saprotrophs. A worldwide monograph was provided by Schumacher who used cladistic analysis and proposed an infrageneric classification with two subgenera, *Scutellinia* and *Legalia*, both represented in Argentina. Phylogenetic relationships derived from partial SSU and LSU rDNA sequence data suggest the main core of *Scutellinia* spp. is closely related to *Cheilymenia fimicola*, but the remaining *Cheilymenia* spp. resolve quite distantly and form a group with *Trichophaea–Anthracobia.* The carotenoid pigment of the disc is characteristic of *Scutellinia* spp. except in *S. nivea* T. Schumach., which has a pale hymenium. The last character and rooted hairs are shared with *Paratrichophaea* Trigaux, but in that genus the ascospores are smooth or slightly punctuate and eguttulate.

Distribution in Argentina: Species recorded from Patagonia (N, RN, TF): *S. badioberbis* (Cooke) Kuntze, *S. bifurcata* Gamundí, *S. colensoi* Massee ex Le Gal, *S. doelloi* (Speg.) Le Gal, *S. hirta* (Schumach.) Cooke, *S. hirtella* (Rehm) Kuntze, *S. kerguelensis* (Berk.) Kuntze, *S. nigrohirtula* (Svrček) Le Gal, *S. nivalis* (Boud.) Le Gal, *S. patagonica* (Rehm) Gamundí, *S. setosa* (Nees) Kuntze, *S. torrentis* (Rehm) T. Schumach. (= *S. marginata* Gamundí), *S. scutellata*, *S. trechispora* (Berk. & Broome) Lambotte, *S. umbrata* f. *antarctica* (Rehm) Gamundí, *S. umbrorum* (Fr.) Lambotte. Species recorded from Central and N Argentina: *S. balansae* (Speg.) Gamundí, *S. cubensis* (Berk.) M.A. Curtis, *S. jungneri* (Henn.) Clem. [cited as *S. lurida* (Henn. & E. Nyman) Le Gal] and *S. olivascens* (Cooke) Kuntze (= *S. lusatiae* (Cooke) Kuntze) from BA, J, ME, MI.

Illustration: Pl. 17, 1–7. *Scutellinia doelloi.*

Literature: Arpin 1969; Denison 1961; Gamundí 1956, 1960, 1964, 1975; Gamundí et al. 2004; Kaushal et al. 1983; Kimbrough & Curry 1986; Korf & Schumacher 1986; Kullman 1982; Le Gal 1966, 1969, 1974; Liu & Zhang 2006; Perry et al. 2007; Pfister 1988; Rifai 1968; Romero & Gamundí 1986; Schumacher 1988, 1990; Svrček 1971; Trigaux 1985; Vooren et al. 2005; Waraitch 1977; Wang 1998; Yao & Spooner 1995a; Zhuang & Wang 1998.

Sowerbyella Nannf. (*Pyronemataceae*)

Ascomata apothecial, epigeous, medium-sized to large, cupulate, superficial, stipitate, scattered to gregarious, sometimes concrescent at the stipe, of fleshy consistency; disc bright yellow to yellow-orange; margin involute, entire to undulate; external surface tomentose, paler than the disc; stipe cylindrical, longitudinally venose, sometimes enlarged in the middle portion and hollow, half or totally buried in the substratum. Ectal excipulum of textura globulosa to angularis with cells arranged in rows perpendicular to the surface, the outermost ending in hyphose, obtuse, septate, hyaline hairs that form the tomentum. Medullary excipulum well developed, a textura intricata of hyaline hyphae sometimes with swollen articles. Asci cylindrical tapering below, 8-spored, J–. Paraphyses straight, cylindrical or slightly enlarged at the apex, hyaline, pluriseptate. Ascospores 1-seriate, uninucleate, hyaline, ellipsoidal, containing 2 guttules, smooth, verrucose, spiny or reticulate, the reticulum being complete or incomplete and derived from the perispore, cyanophilic.

Type species: ***Sowerbyella radiculata*** (Sowerby) Nannf., Svensk Bot. Tidskr. 32: 119. 1938.

Habitat: on damp soil, rotten twigs, and leaves, in woodlands among mosses.

Anamorph: unknown.

Notes: *Sowerbyella* was originally described as having verrucose ascospores and included only two species. It differs from other yellow or orange taxa in paraphyses that do not turn green with iodine and in stipitate ascomata. (See *Aleuria*.) They share the brightly coloured disc, fleshy consistency, and type of ascospore ornamentation. *Otidea* (Pers.) Bonord., which is somewhat related, is distinguished by ascomata that are usually ear-shaped and glabrous and smooth ascospores. A revision of the type species of *Sowerbyella* using SEM for studying the ascospore ornamentation revealed that the marking forms a complete or incomplete reticulum that can vary throughout the same collection. Molecular studies support this viewpoint and show that *Sowerbyella* forms an isolated clade with an unresolved position in the family *Pyronemataceae*. If this new concept of *Sowerbyella* is accepted, the genus is undoubtedly closely related to *Aleuria*.

Distribution in Argentina: Only one species is recorded from the Andean-Patagonian forest, *S. rhenana* (Fuckel) J. Moravec, from CH, N, RN.

Illustration: Pl. 18, 1–8. *Sowerbyella rhenana*.

Literature: Benkert 2005; Eckblad 1968; Gamundí 1960, 1964; Gamundí & Horak 2003; Gamundí et al. 2004; Korf 1972; Moravec 1985, 1988, 1994b; Nannfeldt 1938; Perry et al. 2007; Yao & Spooner 2006; Zhuang 2009.

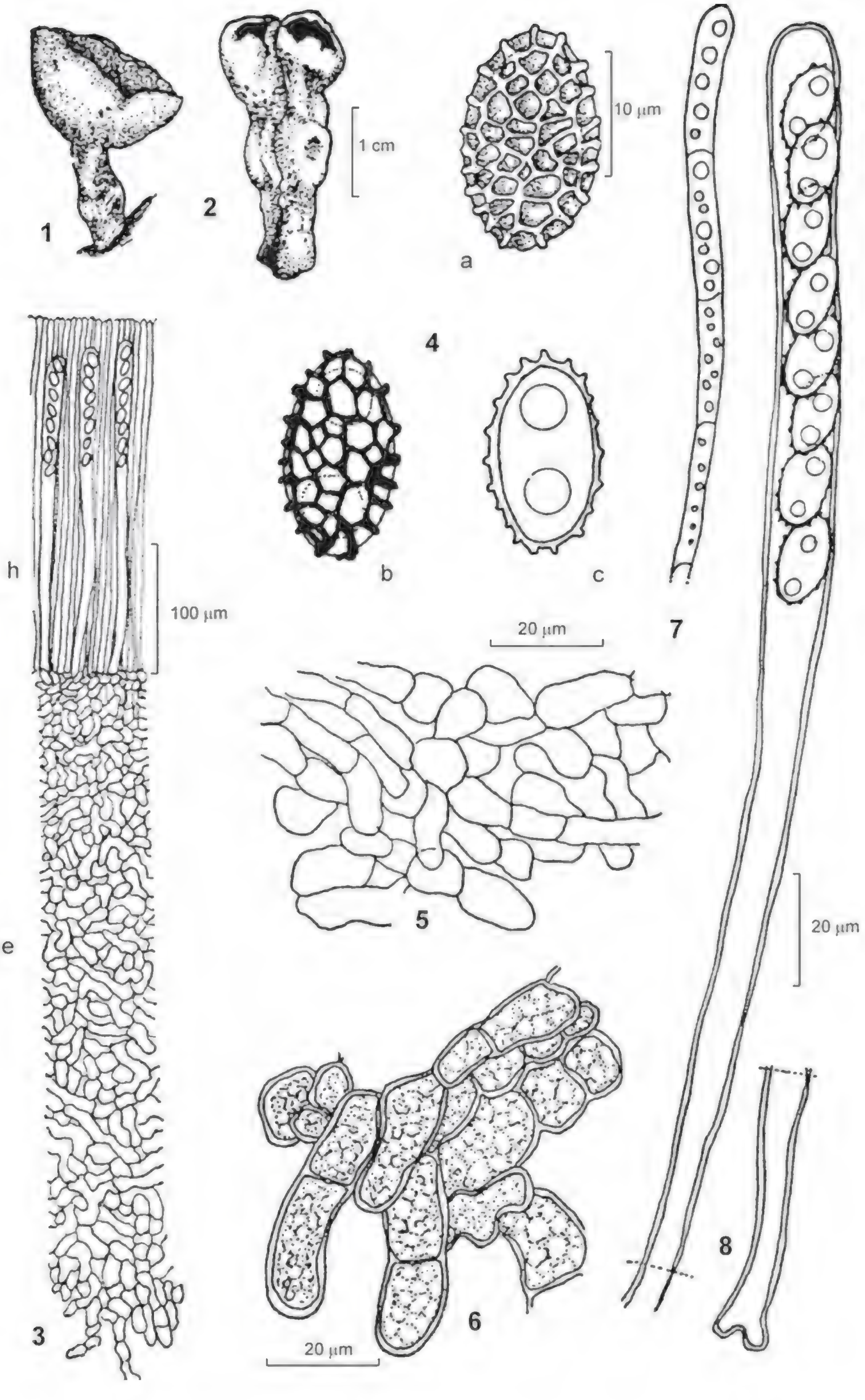
Tricharina Eckblad emend. Chin S. Yang & Korf (*Pyronemataceae*)

Ascomata apothecial, small- to medium-sized, deeply cupulate to discoid, of fleshy consistency, gregarious, sessile, superficial and broadly sessile to partially sunken in the substrate; disc, smooth, white, gray, yellow, orange to brown; margin conspicuous, hairy, with fascicles of hairs arising from the outermost cells of the excipulum, simple, straight or flexuous, pluriseptate, acute or obtuse at the apex with basal cells usually inflated, hyaline, subhyaline or brown-walled. Ectal excipulum a textura angularis to globulosa of hyaline or subhyline cells or the outermost layers with brown-walled cells. Medullary excipulum of textura intricata, hyaline. Asci cylindrical, usually 8-spored, J–. Paraphyses simple, slightly enlarged at the apex. Ascospores usually 1-seriate, uninucleate, eguttulate, but sometimes with polar granules, hyaline, immature ascospores with the cytoplasm staining blue in cotton blue, at maturity very refractive, yellowish with a cyanophylic sheath discernible with cotton blue, ellipsoidal to subfusoidal, smooth or ornamented with fine warts, sometimes arranged in longitudinal stripes.

Type species: ***Tricharina gilva*** (Boud. ex Cooke) Eckblad, Nytt Mag. Bot. 15: 60. 1968.

Habitat: on burnt soil, decayed wood and plant debris.
Anamorph: ***Ascorhizoctonia*** Chin S. Yang & Korf, a *Rhizoctonia*-like anamorph. Mycelium superficial or embedded in the agar-media, hyaline to brownish. Forms aggregates of monilioid, branched cell-chains; cells doliiform containing oil globules.

Plate 18. 1–8. *Sowerbyella rhenana* (BAFC 20579). 1. Mature ascoma. 2. Concrescent young ascomata. 3. Vertical section of the ascoma: h, hymenium, e, excipulum. 4. Ascospores: a, surface view unstained, b, idem. stained with lactic blue, c, optical section. 5. Detail of the excipulum. 6. Excipular furfurations. 7. Paraphyses. 8. Ascus: upper and lower portions.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8
3

Notes: *Tricharina* is similar to *Trichophaea* (see below) and is also related to *Wilcoxina* Chin S. Yang & Korf, which differs in hairs that cover the entire receptacle down to the base and a narrower, uninflated basal cell. Its anamorph is the chlamydosporic *Complexipes* C. Walker emend. Chin S. Yang & Korf, which forms ectomycorrhizae.

Trichophaeopsis, a segregate of *Trichophaea* that is also similar but characterized by bifurcate hairs, is distinguished by an ectal excipulum formed by horizontally elongated, thick-walled brown cells and ascospores lacking oil globules but with de Bary bubbles.

The relationship of *Tricharina* with *Geopora* is supported by molecular studies using partial nLSU rDNA and SSU rDN sequences from various species of both genera that differ morphologically in ascospore guttulation and hair morphology (see description of *Geopora*). The figures given to illustrate the genus *Tricharina* were published as *Trichophaea fimbriata* (Quél.) Gamundí (1966) after examination of the type specimen in Cooke´s Herbarium (K). In the revision of *Tricharina* by Yang & Korf (1985), *T. fimbriata* is considered a synonym of *T. gilva* for nomenclatural reasons, a view that I accept. However, the Argentine collection has ascospores that agree in form and size [15–16.6(–18.3) × 8.3–10 µm] with the type specimen of *Lachnea fimbriata* Quél. Brummelen (1983) stated that *T. gilva* is very variable in ascospore size and length/breath ratio.

Distribution in Argentina: two species are recorded: *T. gilva* (= *Trichophaea fimbriata* (Boud. ex Cooke) Gamundí and *T. striispora* (Rifai) Chin S. Yang & Korf, from BA and RN.

Illustration: Pl. 19, 1–7. *Tricharina gilva.*

Literature: Barrera & Romero 2001; Brummelen 1983; Dennis 1978; Dissing 2000; Eckblad 1968; Egger 1996; Gamundí 1966, 1975; Gamundí & Lorenzo 2001; Gamundí et al. 2004; Korf 1985; Korf & Erb 1972; Liu & Zhuang 2006; Perry et al. 2007;Svrček & Kubička 1961; Wu & Kimbrough 1996; Yang & Korf 1985a,b; Yang & Kristiansen 1989.

Trichophaea Boud. (*Pyronemataceae*)

Ascomata apothecial, small- to medium-sized, sessile, discoid to pateliform, gregarious, of fleshy consistency; disc smooth, plane to concave, whitish, pale bluish, grayish to pale ochraceous grayish; margin conspicuous, hairy, covered with scattered, long, superficial hairs, isolated or in fascicles, acute and rigid, pluriseptate, thin-walled, hyaline, yellowish or brown, simple sometimes with

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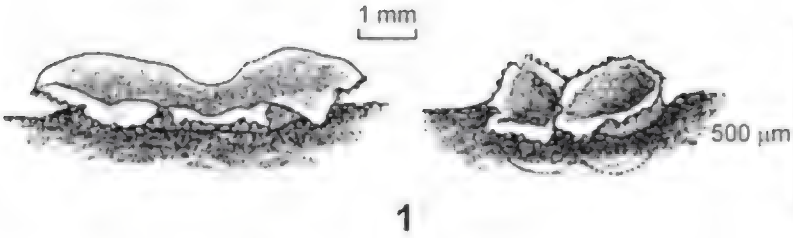
Plate 19. 1–7. *Tricharina gilva* (BAFC 22002). 1. Ascomata. 2. Sketch of a vertical section of the ascoma: h, hymenium, m, medullary excipulum, c. ectal excipulum, bh, basal hairs, mh, marginal hairs. 3. Ascus and paraphyses. 4. Marginal hairs. 5. Vertical section of the ascoma: m, c and bh as in fig. 2. 6. Ascospores: a, surface view, b, optical section. 7. Immerse mycelia in a 4-week culture at room temperature: a, filter paper medium, chlamydospore-like cells, b, APG medium, young mycelium.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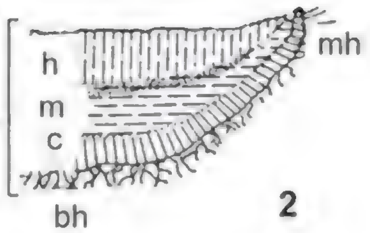
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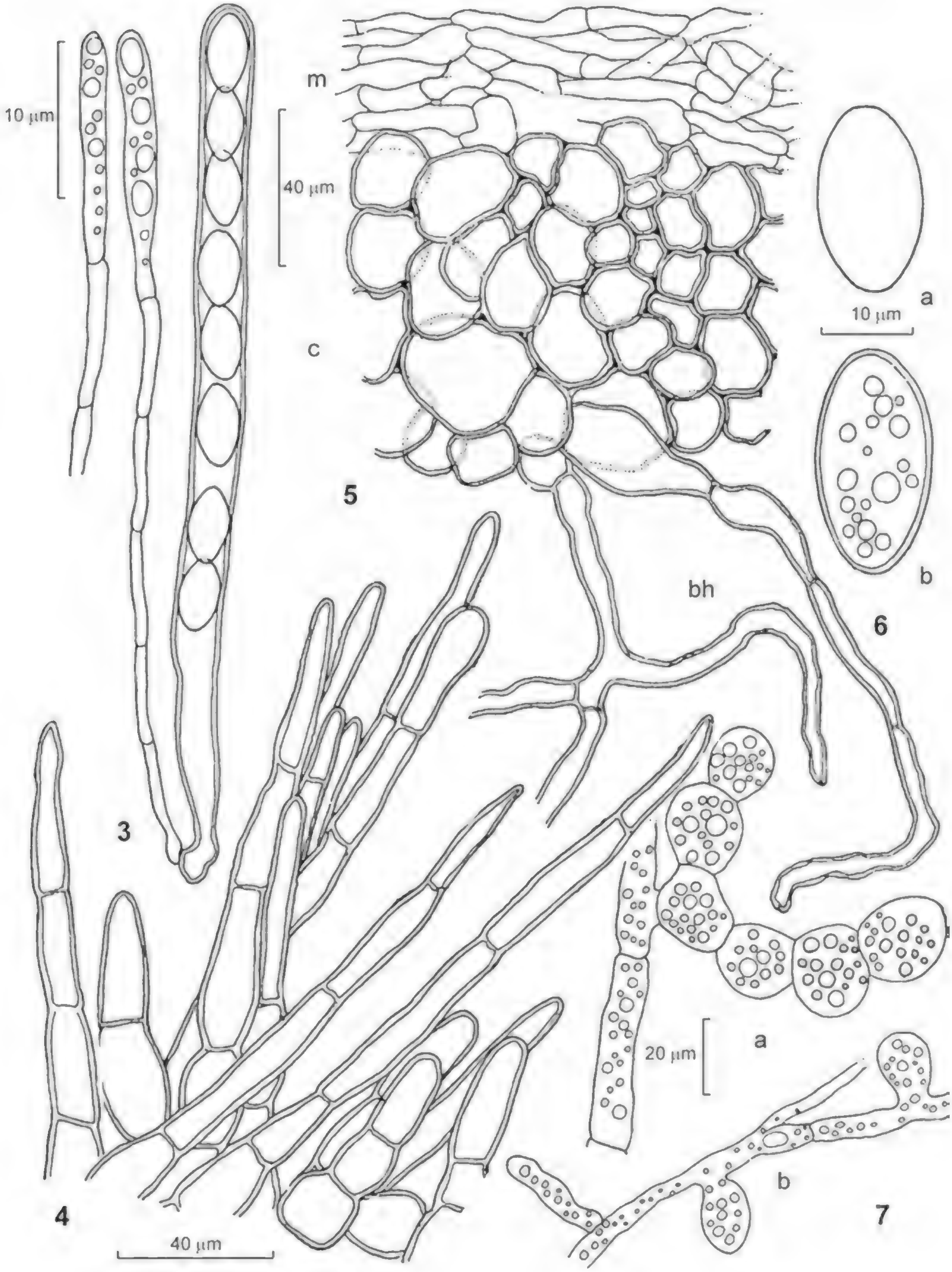
10 µm
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6
a
20 µm
b
7
4
40 µm

a bulbous base or atenuated at the base; external surface concolorous with the disc or brownish. ECTAL EXCIPULUM of textura angularis to globulosa, composed of isodiametric cells with hyaline or brown walls, arranged in rows perpendicular to the external surface, the most superficial sometimes forming patches of brown cells from where the hairs arise. MEDULLARY EXCIPULUM of textura intricata, hyaline. ASCI cylindrical, 8-spored, J–. PARAPHYSES simple, clavate at the apex, hyaline, septate. ASCOSPORES 1-seriate, uninucleate, hyaline, subglobose, ellipsoidal to fusoid, smooth or ornamented with small to large warts, guttulate, sometimes with de Bary bubble.

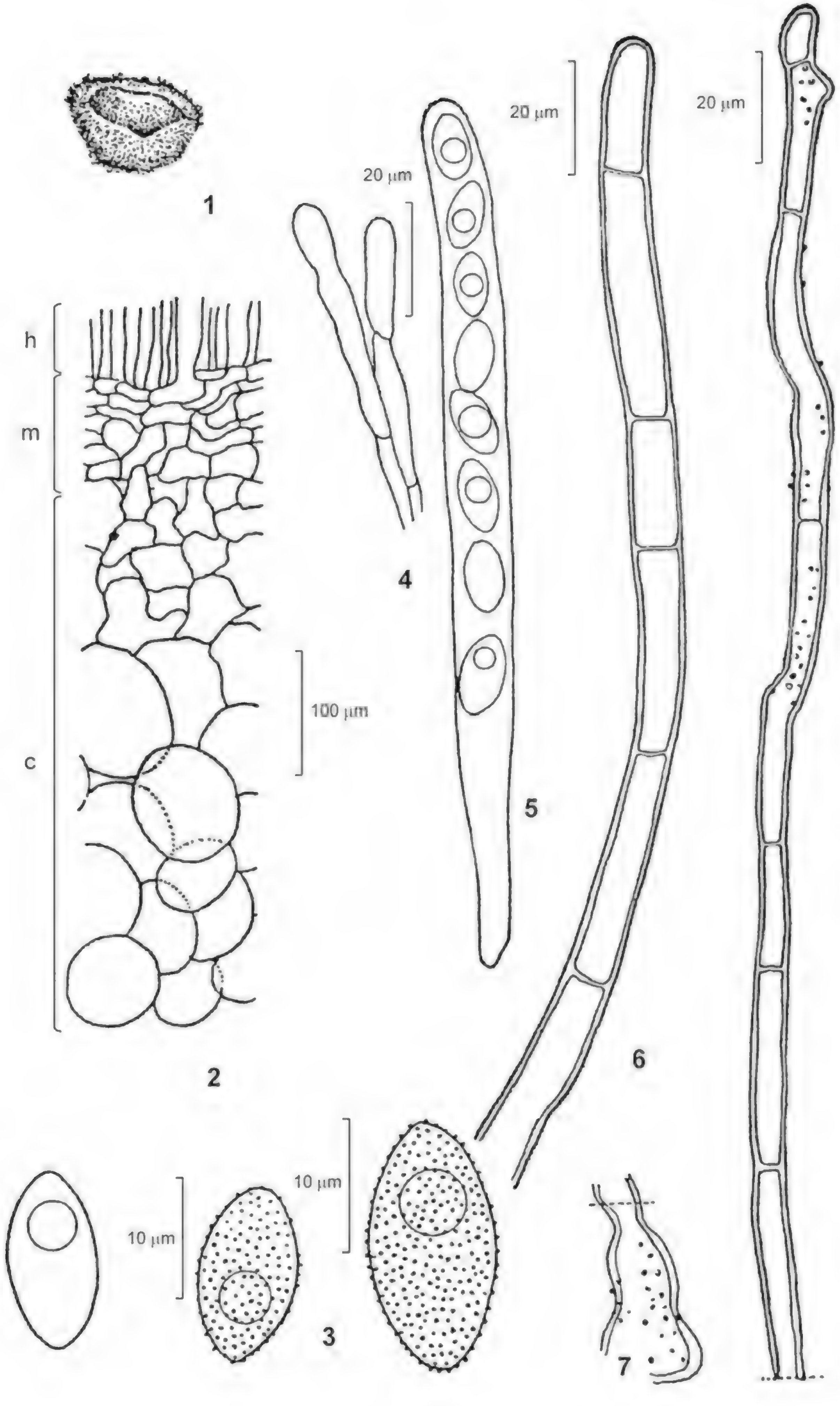
TYPE SPECIES: ***Trichophaea woolhopeia*** (Cooke & W. Phillips) Arnould, Bull. Soc. Mycol. France 9: 112. 1893.

HABITAT: on clayish or burnt soil, on plant debris and mushroom beds.

ANAMORPH: ***Dichobotrys*** Hennebert. Conidiophores mononematose, hyaline, erect, dichotomously furcate at about half height, with primary and secondary branches; conidiogenous cell sympodioblastic; conidia holoblastic, hyaline, unicellular, subglobose to napiform, smooth.

NOTES: *Trichophaea* is related to other hairy *Pyronemataceae* such as *Anthracobia* but differs in its long, pointed hairs (see *Anthracobia* above). Some species of both genera may colonize burnt places but can be distinguished at first sight by the colour of the disc. Also related is *Sphaerosporella,* which has globose, uniguttulate ascospores. Ultrastructure examination of the ascospore wall led some authors to reunite *Sphaerosporella* and *Trichophaea*. Both genera also have the same anamorph genus, *Dichobotrys*. *Trichophaeopsis* differs in its bifurcate hairs and superficial excipular cells arranged in vertical rows. *Tricharina* also shows affinity with *Trichophaea,* which has an *Ascorhizoctonia* anamorph. *Paratrichophaea* differs in its setiform hairs arising deeply in the excipulum and eguttulate ascospores. Some species of pyrophilous *Trichophaea* can complete the life cycle in vitro but ascospores may need to be submitted to a heat shock to stimulate germination. Others, non-pyrophilous, can form ectomycorrhiza with *Betula* and *Picea,* a symbiosis confirmed by experimental and molecular studies. Ultrastructural septal structure (TEM) showed that *Trichophaea* has the aleurioid-type of ascospores (see NOTES in *Aleuria*). Results on ascospore ontogeny demonstrated that smooth-spored and pyrophilous species form *Dichobotrys* anamorphs, whereas rough-spored species are non-pyrophilous and do not form anamorphs. Phylograms generated from SSU rDNA data analyses suggest affinity with *Wilcoxina*, which has *Complexipes* anamorphs.

PLATE 20. 1–6. *Trichophaea gregaria* (LIL, Singer T-2266). 1. Ascoma. 2. Vertical section of the ascoma: h, hymenium, m, medullary excipulum, c, ectal excipulum. 3. Ascospores in optical section and surface view. 4. Paraphyses. 5. Ascus. 6. Marginal hair. 7. Basal hair, base and terminal portion.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Partial nLSU rDNA sequence analyses suggest that *Trichophaea* is non-monophyletic. A clade “7”, with smooth ascospores and *Dichobotrys* anamorph suggest a close connection with *Sphaerosporella,* while clade “8” (diagnosed by ornamented ascospores and without any anamorph) is related to *Wilcoxina.*

Distribution in Argentina: one species was found: *T. gregaria* (Rehm). Boud. from BA.

Illustration: Pl. 20, 1-7. *Trichophaea gregaria.*

Literature: Coetzee & Eicker 1994; Dennis 1978, 1981; Dissing 2000; Gamundí 1960; Hennebert 1973; Hennebert & Bellemère 1979; Kanouse 1958; Kimbrough 1994; Korf 1988; Korf & Erb 1972; Landvik et al. 1997; Liu & Zhuang 2006; Maas Geesteranus 1967; Perry et al. 2007; Pfister 1988; Rifai 1968; Tedersoo et al. 2005; Trigaux 1985; Svrček & Kubička 1961; Vooren et al. 2005; Webster et al. 1964; Wu & Kimbrough 1995; Yang & Korf 1985a,b.

Trichophaeopsis Korf & Erb (*Pyronemataceae*)

Ascomata apothecial, minute to small, turbinate, gregarious, of fleshy consistency, sessile; disc plane or concave, whitish to dull yellow; margin elevated, undulate, hairy; external surface densely covered by straight, dark brown, acute, thick-walled, pluriseptate setae, some of them bifurcate usually with two unequal branches, the longest pointing upwards, lower part of the ascoma covered with flexuous hyaline to brownish, thin-walled, simple hairs, with a bulbous base. Setae and hairs are of superficial origin. Ectal excipulum of textura prismatica, one- or two-layered, composed of thick-walled, brown cells, in surface view horizontally elongated. Medullary excipulum well developed, of a compact textura intricata, hyaline. Asci cylindrical, 4–8-spored, J–. Paraphyses simple, filiform, hyaline. Ascospores usually 1-seriate, uninucleate, eguttulate, smooth or punctuate, hyaline or pale yellowish and very refractive, sometimes with a de Bary bubble.

Type species: ***Trichophaeopsis bicuspis*** (Boud.) Korf & Erb, Phytologia 24(1): 18. 1972.

Habitat: on dung, soil or plant debris.
Anamorph: unknown.

Notes: *Trichophaeopsis* is characterized by its very thin, dark ectal excipulum and bifurcate setae that separate it from *Trichophaea* with simple hairs and different type of ectal excipulum (compare descriptions). The genus, which includes two species (and one subspecies), it is said by its authors to occupy an isolated position among the operculate discomycetes. It was recently suggested

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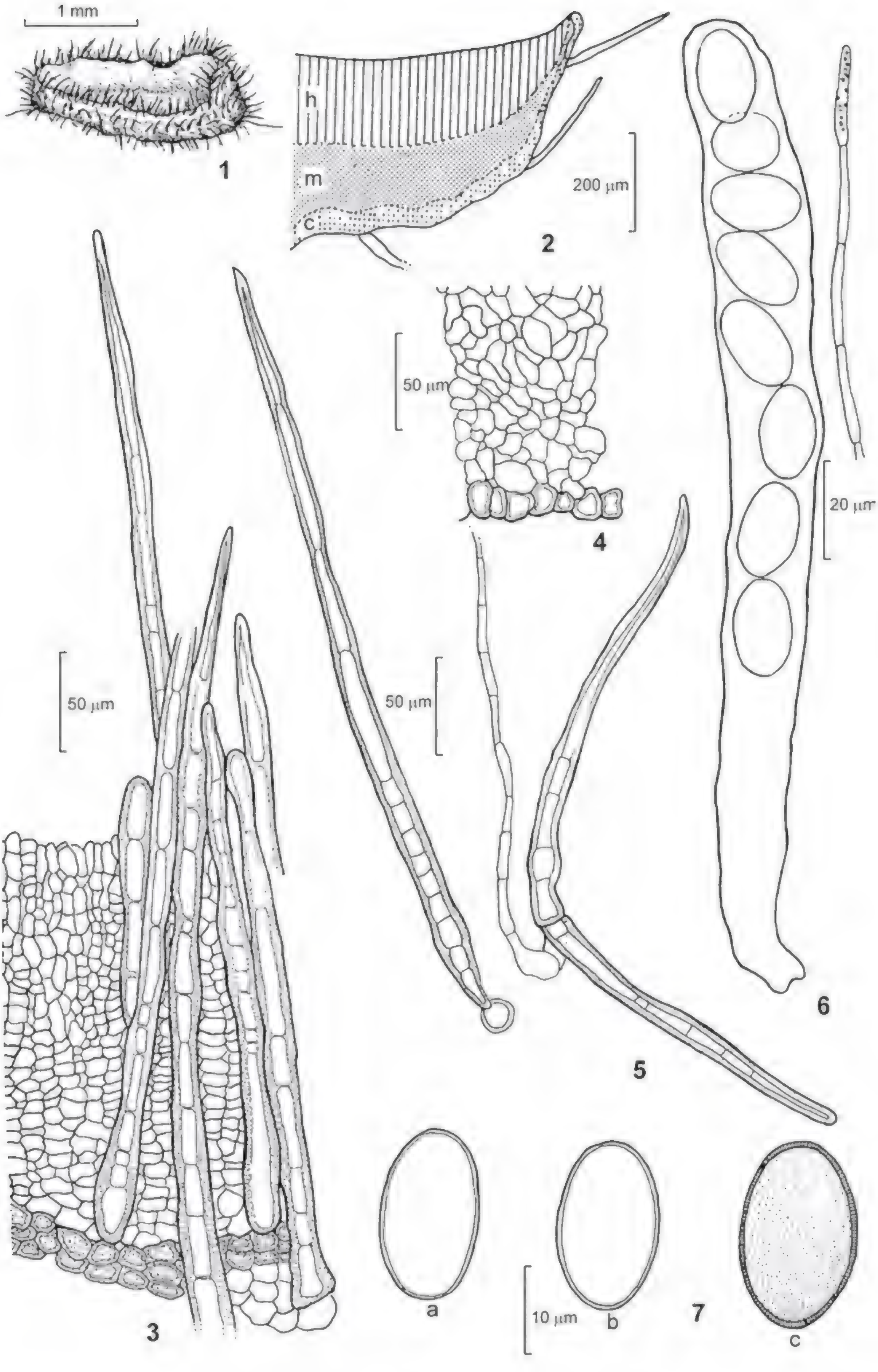
Plate 21. 1–7. *Trichophaeopsis bicuspis* subsp. *eguttulispora* (LPS 36891). 1. Ascoma. 2. Sketch of a vertical section of the ascoma: h, hymenium, m, medullary excipulum, c, ectal excipulum. 3. Margin and ectal excipulum in surface view. 4. Detail of the ectal excipulum. 5. Setiform and hyphoid hairs. 6. Ascus and paraphyses. 7. Ascospores: a, b unstained, c, iodine stained.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that its closest relative is *Rhizoblepharia* Rifai. This relationship seems remote, as hairs in this genus are rooting, the ascospores are fusoid and covered with transverse, cyanophobic ridges recalling those of some *Sarcoscyphaceae. Wilcoxina* is different in excipular structure and hairs. *Paratrichophaea* differs basically in its simple setae that arise in the medullary excipulum. Molecular studies using parsimony and Bayesian analysis of partial sequences of SSU and LSU rDNA suggests a relationship of *Trichophaeopsis* with *Wilcoxina* and a group of *Trichophaea* spp. The synonymy of *Trichophaea gilva* (Boud. ex Cooke) Gamundí, a homotypic synonym of *Tricharina gilva,* with *Trichophaea eguttulispora* Gamundí that appeared in Gamundí et al. (2004: 141) is erroneous; the correct name of the latter taxon is *Trichophaeopsis bicuspis* subsp. *eguttulispora* (Gamundí) Korf.

ILLUSTRATION: Pl. 21, 1–7.*Trichophaeopsis bicuspis* subsp. *eguttulispora.*

DISTRIBUTION IN ARGENTINA: only *T. bicuspis* subsp. *eguttulispora* from TF.

LITERATURE: Barrera & Romero 2001; Dissing 2000; Dissing & Paulsen 1976; Gamundí 1975; Gamundí et al. 2004; Häffner & Krieglsteiner 1991; Hansen & Pfister 2006; Korf 1977; Korf & Erb 1972; Landvik et al. 1997; Liu & Zhuang 2006; Perry & Pfister 2008; Perry et al. 2007; Pfister 1988; Trigaux 1985; Vooren et al. 2005; Yang & Korf 1985a;b; Yang & Kristiansen 1989.

Underwoodia Peck (*Helvellaceae*)

ASCOMATA pileate, cylindrical or clavate, straight or slightly curved, large, up to 25 cm long, superficial, stipitate with the pileus completely adnate to the stipe, gregarious to cespitose, sometimes concrescent, of fleshy consistency drying leathery, internally entirely hollow or alveolate; hymenium brown, grayish-brown or black, covering the upper part of the ascoma, smooth or sulcate; stipe cylindrical, somewhat bulbous at the base, smooth or sulcate with longitudinal ribs that may anastomose, internally hollow or lacunose and externally minutely furfuraceous, paler than the hymenium or whitish. PILEUS in transverse section showing: a) hymenium as the outermost layer, followed by b) a trama of compact textura intricata and c) a palisade-like inner layer of textura prismatica. STIPE 3-layered, composed of: a) External palisade-like layer composed of septate hyphae disposed in rows perpendicular to the surface, the outermost ending freely to form the furfurations; b) Medium layer (trama) of textura intricata of hyaline, septate hyphae; c) Inner layer palisade-like of hyaline hyphae, similar

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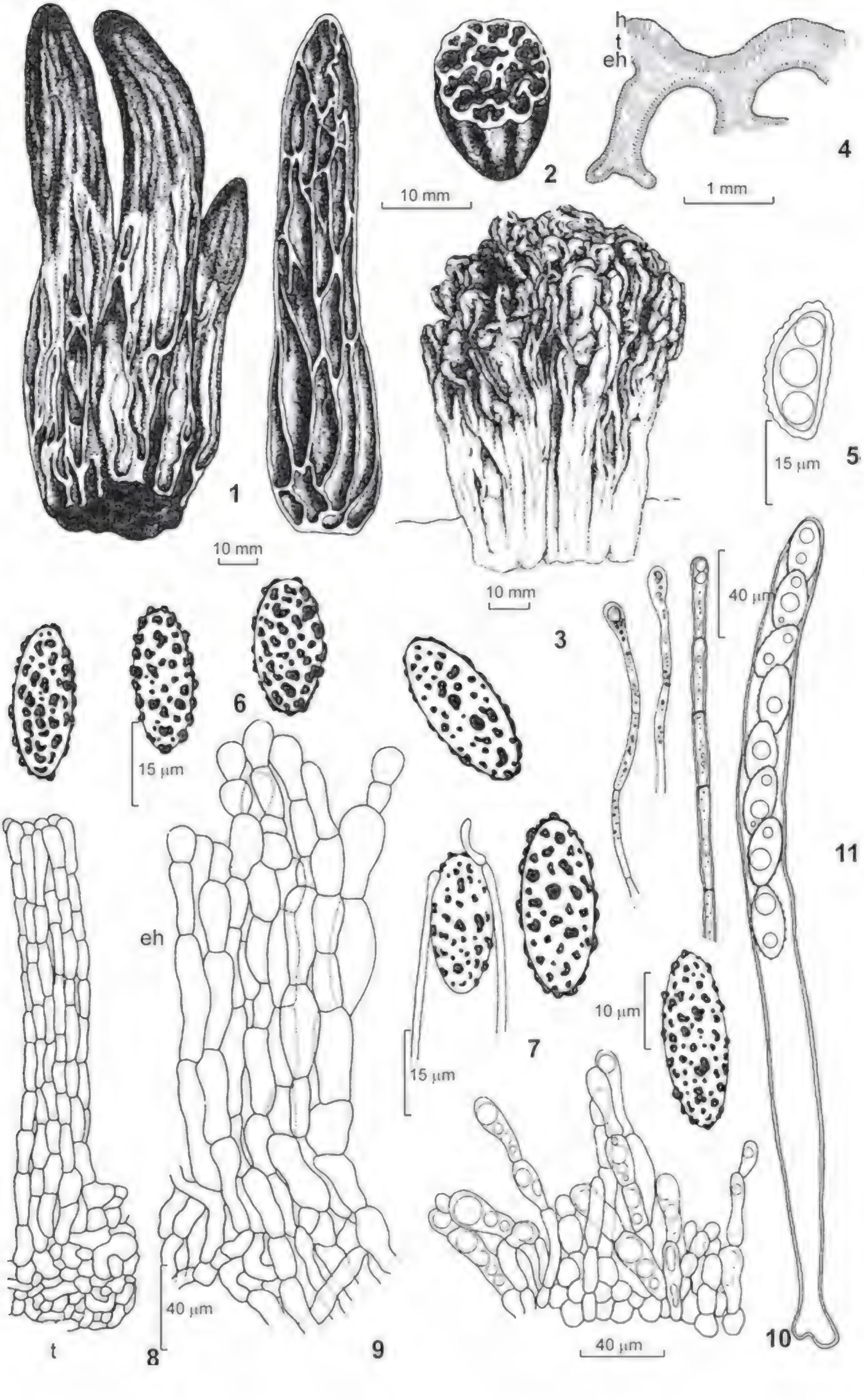
PLATE 22. 1–11. *Underwoodia fuegiana* (BAFC 20001). 1. Ascomata, one in vertical section. 2. Cross section of the ascoma at the pileus level. 3. Several concrescent ascomata. 4. Sketch of a cross section of the pileus: h, hymenium, t, trama, eh, palisade-like layer. 5. Ascospore, optical section. 6. Ascospores, surface view. 7. Dehiscent ascus. 8. Detail of the palisade-like layer of the pileus: eh, t, as in FIG. 4. 9. Detail of the palisade-like layer of the stipe. 10. Detail of stipe furfuration. 11. Ascus and paraphyses.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40 µm
10

to the inner layer of the pileus. ASCI cylindrical to subcylindrical, 8-spored, pleurorhynchous, J–. PARAPHYSES straight or curved and slightly enlarged at the apex, someties forked near the base, containing pigmented granules or diffused pigment. ASCOSPORES 1–2 seriate, 4-nucleate, containing 1–3 guttules, hyaline to subhyaline, ellipsoidal to subfusoidal, coarsely verrucose or papulose, warts rounded of unequal size, cyanophilic.

TYPE SPECIES: ***Underwoodia columnaris*** Peck, Ann. Rep. N.Y. St. Mus. 43: 32. 1890.

HABITAT: on soil in the forest or in disturbed prairies nearby forests, sometimes among mosses and ferns, occasionally on wood.
ANAMORPH: unknown.

NOTES: *Underwoodia* is the legitimate name for *Geomorium* Speg. It shares with *Helvella* the character of 4-nucleate ascospores but dictinct by its adnate pileus and ascospore rougher ornamentation. Formerly several authors suggested the synonymy with *Helvella* but others considered it a separate genus. Recent studies confirm the identity of *Underwoodia* as a genus (See NOTES under *Helvella).* Moreover, phylogenetic relationships derived from molecular studies suggest that *Underwoodia* diverges from *Helvella* and from the hypogeous genera *Barssia* and *Balsamia*, all included in the family *Helvellaceae*. Species of North America are recorded as poisonous but no data on this respect have been recorded for the Argentinian collections. No type of mycorhiza has been confirmed for this genus, but our personal field observation on *U. singeri* Gamundí & E. Horak shows rhizomorphs arising from the base of the stipe which are in contact with the root system of vascular plants. *U. fuegiana* occasionally shows a sparassoid form derived from confluent ascomata when growing in grazing land.

DISTRIBUTION IN ARGENTINA: two species are recorded in the Andean-Patagonian forests: *U. fuegiana* (Speg.) Gamundí and *U. singeri.* from: N, RN, TF.

ILLUSTRATION: Pl. 22, 1–11. *Underwoodia fuegiana.*

LITERATURE: Ammirati et al. 1985; Abbott & Currah 1997; Dissing 1966; Eckblad 1968; Gamundí 1957b, 1975; Gamundí & Horak 1979, 2003; Korf 1973a; Landvik et al. 1999; O´Donnell et al. 1997; Rifai 1968.

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